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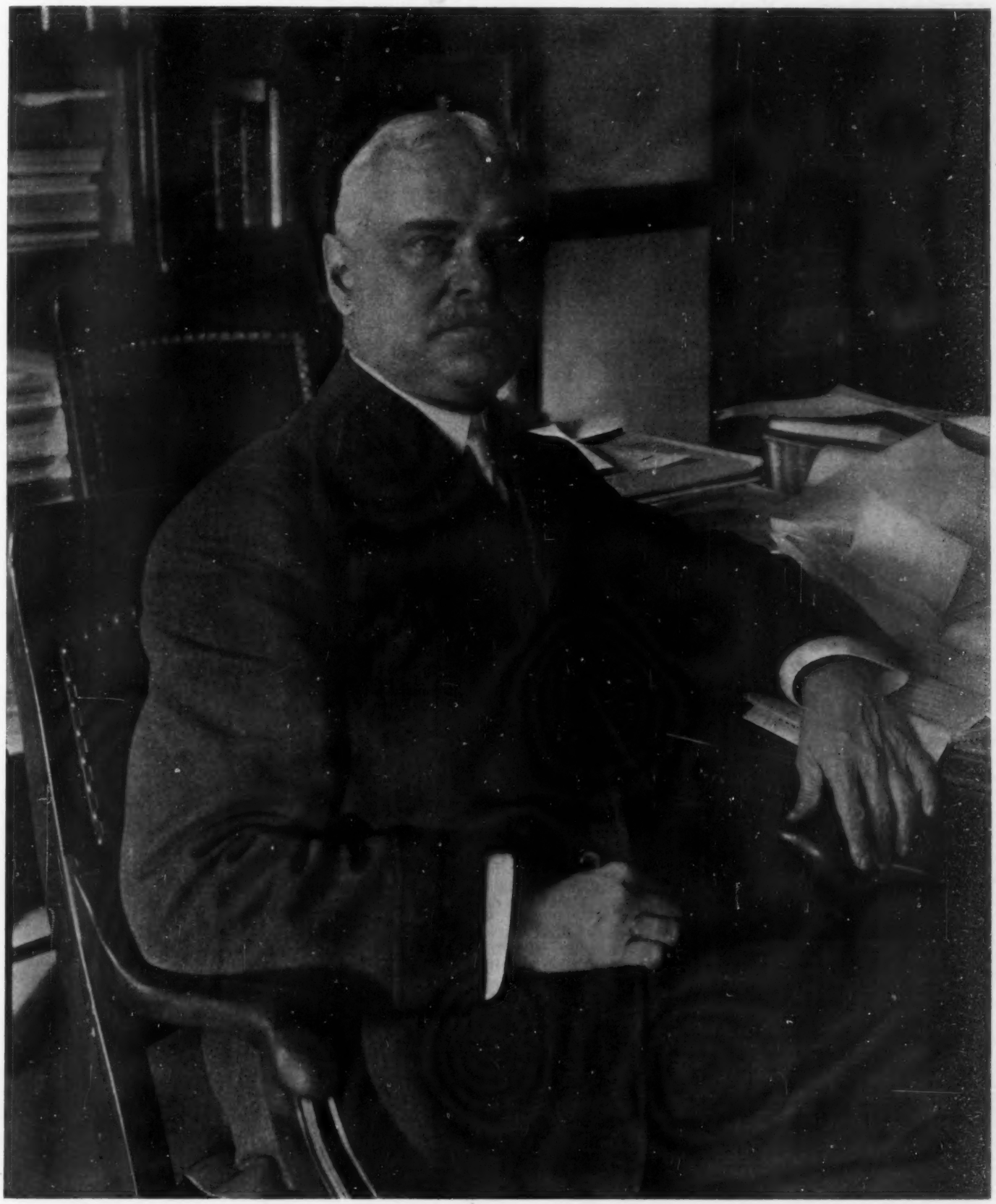

COL. GEORGE WASHINGTON GOETHALS, CANAL BUILDER. – [See page 567.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

National Archives in Danger

IF it were to be shown that the national archives of the United States, including the original Declaration of Independence and the Constitution, were in danger of destruction, and that they could be reasonably protected by the expenditure of a sum of ten thousand dollars, one would think that no time would be lost in taking this very economical step for their protection.

It is a fact that not merely these priceless documents, but a large collection of others of scarcely less value, are at present arranged on wooden shelves, in wooden wall-cases, at the Department of State, where in case of a fire, they might quickly share the fate of the State documents in the recent fire at the Capitol at Albany, and be wiped out of existence.

It is also true that in spite of the fact that the peril of these documents has over and over again been brought to the attention of Congress, and that reiterated requests have been made for the petty appropriation which is necessary for their protection, the National Legislature thus far has done nothing.

The truth regarding this matter, whose seriousness can scarcely be overestimated, was brought to public attention in a recent issue of the New York *Times*, which journal, in view of the unique character of the records, cannot be far from the truth in designating them as "the most wonderful and most valuable collection of documents in all the world."

Can it be otherwise when it includes, in addition to the original document of the Declaration of Independence and of the Constitution of the United States, the following original records: The Articles of Confederation of the Colonies, and all the other papers relating to the formation of the Government; a series of bound volumes of the laws of the United States, including all the bills passed by Congress and signed by the President since the beginning of the Government; the original documents of the treaties of the United States, 559 in number, among which is included the treaty of peace made with England at the close of the War of the Revolution; some thirty volumes of the records and papers of the Continental Congress; a number of volumes of papers of Franklin, relating to foreign affairs, etc.

The appropriation of ten thousand dollars will serve to replace the wooden wall-cases with cases of steel, made as nearly fire-proof as possible. These will serve to give the records a certain measure of safety until the completion of the new building which the State Department will occupy in four or five years' time, in which will be a fire and burglar-proof vault, built specially for the safe keeping of this invaluable national heritage.

In safeguarding against fire risk, would it not be well to safeguard future records of this kind against that other destroying agent, the slow hand of time? The Declaration of Independence is already all but illegible. If pure linen and a pure carbon ink were used, the result would be practically indestructible. This suggestion was made by Dr. William J. Manning of the Government Printing Office, in an article published in the SCIENTIFIC AMERICAN of June 6th, 1908, which will well repay careful consideration at the present time.

Serious but not Alarming

THE volcanic nature of the geological formation of the range of hills through which the great Culebra cut is being excavated is causing our army engineers at the Isthmus a great deal of trouble, and is adding a considerable sum to the cost of the Panama Canal. When the French, under De Lesseps, some twenty-five years ago commenced to bite their way into the Culebra divide, they were at once confronted with the delay and expense involved in the sliding of the hillside into the excavated cut. The material which moved down was composed mainly of the mass of clay which overlaid the surface of the slopes, and it was the belief of the French, as it was also the belief of our American engineers at a later date, that when the cutting had been carried down to the firmer, underlying rock, there would be no further trouble from this source.

Unfortunately, the rock has proved to be so badly fissured and generally of such an unstable character that it has refused to hold the angle of slope at which the canal is being cut. As the excavation has gone down, huge masses of material, many acres in extent, have started to slide, generally upon some underlying stratum where friction was unequal to the task of holding the superincumbent weight against the pull of gravity. The Culebra cut extends for a distance of about nine miles, and at present over a score of slides are in motion, more than one-half of these being of considerable size. Over one-fourth of the total length of the cut shows evidence of instability, and is either moving or liable to move before the work is done.

The largest of the slides, if we take account of its area, is the one at Cucaracha, which already has a total surface area of about 50 acres. This is the slide which caused the French so much trouble. Since American occupation, over two million cubic yards have been removed, and there is a possibility that another two million cubic yards must be handled before the slope has reached an angle of repose. Near Gold Hill are two other slides, with a total area of about 35 acres, from which three million cubic yards have already been taken, and where at least another two million cubic yards must be removed.

As the cut is carried down to its final depth, conditions will, of course, be aggravated. Other slides will start, and existing slides will reach farther up the slopes of the hillside. It is impossible to predict to what magnitude the present movements may ultimately attain as the cut is carried down to grade; and there is, of course, some possibility that portions of the cut which are now stable will ultimately give way. By the present methods of excavation and removal by steam shovel and work train, the cost of getting rid of the slides is about 50 cents a cubic yard. Colonel Goethals, in estimating the cost of completing the canal, made a liberal allowance—if we remember rightly, about six million dollars—for the removal of slides.

The problem presented is serious, but not alarming; although the fact that the pressure from the sides has in some cases caused the rock at the bottom of the cut to bulge upward, comes pretty near to being alarming. The trouble will be mitigated, in all probability, by impounding the water at Gatun as early as possible, and so flooding the Culebra cut. The pressure of the water will tend to preserve equilibrium. Moreover, it will then be possible to remove the slides by floating dredges, at a cost, for loose material, about one-third of the present cost. There is nothing for it but to keep removing the slides as they come in. It is not probable that they will delay the completion of the canal, although floating dredges may have to be maintained in the Culebra cut for some time after the opening of the canal.

The Science of Breeding Better Men

ADA JUKE is known to anthropologists as the "mother of criminals." From her there were directly descended one thousand two hundred persons. Of these, one thousand were criminals, paupers, inebriates, insane, or on the streets. That heritage of crime, disease, inefficiency and immorality cost the State of New York about a million and a quarter dollars for maintenance directly. What the indirect loss was in property stolen, in injury to life and limb, no one can estimate.

Suppose that Ada Juke or her immediate children had been prevented from perpetuating the Juke family. Not only would the State have been spared the necessity of supporting one thousand defective persons, morally and physically incapable of performing the functions of citizenship, but American manhood would have been considerably better off, and society would have been free from one taint at least.

Instances such as these are not isolated. Ever since the late Sir Francis Galton gave us his science of Eugenics, which in its most literal sense means "good breeding," the scientific students of mankind, the directors of insane asylums and hospitals, criminologists the world over, have been compiling statistics to show not only the danger of permitting the marriage of criminals, lunatics, and the physically unfit, but the effect upon mankind. Thus, Prof. Karl Pearson, Galton's ablest disciple, has driven home the necessity of the scientific study of the human race in many a telling statistical comparison and monograph. He has shown that in Great Britain 25 per cent of the population (and that the undesirable element in England) is producing 50 per cent of English children, and that if this goes on unchecked, national deterioration and degeneracy must inevitably result.

Galton originally worked only with statistics, and in his capable hands, they proved a powerful weapon. After he had enunciated the principles of Eugenics, Mendel's law of heredity was revived and applied to the problem. Imperfectly understood as that law may be as yet, nevertheless it enables us to prophesy with considerable accuracy what the offspring of animals, plants and human beings may be, not only in the next generation, but in generations to come. Mendelian principles have no doubt long been followed by professional animal breeders in an empirical way, but only within recent years have enough data been accumulated to show that they apply with equal force to human beings. We know enough about the laws of heredity, we have enough statistics from insane asylums and prisons, we have enough genealogies, to show that, although we may not be able directly to improve the human race as we improve the breed of guinea pigs, rabbits or cows, because of the rebellious spirit of mankind, yet the time has come when the lawmaker should join hands with the scientist, and at least check the propagation of the unfit. Prizes have been offered to crack trotters for beating their own record, $10,000 for a fifth of a second, all for the purpose of evolving a precious two-minute horse. Yet we hear of no prizes which are offered for that much worthier object, the physically and intellectually perfect man. Fortunately the need of intelligent legislation on the subject is being driven home by scientific men and Eugenic associations here and abroad. The Eugenics laboratory founded by Sir Francis Galton and the American Breeders' Association have done much to clear away the popular prejudices inevitably encountered in such educational work and to prepare the ground for legislative action. Some States have already passed laws that show an appreciation of the situation.

The proper attitude to be taken toward the perpetuation of poor types is that which has been attributed to Huxley. "We are sorry for you," he is reported to have said; "we will do our best for you (and in so doing we elevate ourselves, since mercy blesses him that gives and him that takes), but we deny you the right to parentage. You may live, but you must not propagate."

The absurdity of legislation to cure social evils without scientific facts to base that legislation upon, is no more apparent than in the disposal of the insane. In Wethams's "Family and the Nation," it is stated: "According to the mid-Victorian concept, a man was either sane or insane—quite mad or completely cured. How he became mad, how completely he was cured, were not taken into consideration." It is not enough to take care of an insane man. To discharge him after a period of a few months or a few years and brand him as cured, when his whole family history points to the fact that he is a hereditary epileptic or lunatic, and to place no barriers in his path when he attempts to marry, is statesmanship of the poorest order.

If the Eugenist has his way, "well-born" will acquire a new meaning. It will not cease to mean descent from a proud and noble race that has accomplished great things in the past, but it will also mean that the stock descended from that race is composed of men and women who will live up to its traditions, who will have that perfect physique and stable mental organization which Maudsley, that most literary and philosophical of psychiatrists, calls "the highest sanity."

The Paris-Rome-Turin Aeroplane Race

Description of the First Two Stages of the First Great European Circuit

COMING a week after the disastrous inauguration of the Paris-Madrid race, the start of the first great European circuit aeroplane race was keenly followed by all aviation enthusiasts in Europe and America. This circuit, which was organized by the *Petit Parisien*, is for prizes amounting to $100,000. It is a go-as-you-please race, the aviators having from May 28th until June 15th in which to cover the distance of 2,095 kilometers, or 1,300 miles. The race is in three stages, the first from Paris to Nice being over a distance of 865 kilometers (537 miles) with recording stations at Dijon, Lyons, and Avignon. The second stage extends from Nice to Rome—600 kilometers (372 miles)—with stopping points at Genoa and Pisa. In the last stage the aviators expect to retrace their course up through the central part of Italy and around to Turin *via* Florence and Bologna. The distance in this stage is 630 kilometers (391 miles).

The start was made under perfect weather conditions at 6 A. M. on the morning of Sunday, May 28th. Of the twenty-one competitors, twelve were on hand at the start and were despatched within an hour. M. Vedrines had not returned from Madrid and was consequently unable to start on Sunday. M. Roland Garros, who raced Vedrines with such vigor in the Paris-Madrid contest, was the first to cross the line at Buc. He was closely followed by Lieut. Conneau, who, as in the other race, flew under the name of André Beaumont. Both aviators used Blériot monoplanes. The latter passed the former and covered the 645 kilometers (401 miles) to Avignon in 12¾ hours, as against 13 hours and 35 minutes required by Garros. Lieut. Conneau passed Garros on the way to Dijon (160 miles) and arrived there at 11:21 A. M., having covered the distance in 5 hours and 19 minutes. Garros arrived at 11:40 A. M., after having required 5 hours and 40 minutes to cover the 160 miles. The next stop—Lyons (105 miles from Dijon)—was reached by Conneau at 3:28 P. M. After re-starting he finally arrived at Avignon, 401 miles from Buc, at 6:47 P. M. Garros, as above stated, arrived somewhat later. Most of the other competitors met with mishaps and "broke wood," as the expression is in aviation. M. Henri Molla, on a Blériot monoplane, and Herr Frey, on a Morane monoplane, finally reached Dijon about 7 P. M. The American aviator, Weymann, on his Nieuport monoplane, was especially unlucky. After two stops because of engine trouble he was forced to descend in a field near Troyes. The propeller was broken and the machine was damaged, but he was not injured.

The second day of the race the leaders were unable to make more than 220 kilometers (126 miles) on account of bad weather and many minor mishaps. Lieut. Conneau was the first to arrive at Nice, where he swooped down from the clouds at 7:20 P. M., followed half an hour later by Garros. The former had been compelled to descend at one of the small towns near Nice. While he was re-filling his fuel tanks Garros passed overhead. Conneau immediately jumped into his machine and started off in the teeth of a blinding rainstorm. Meanwhile Garros lost his way and was forced to descend, but Conneau managed to locate Nice and land without a mishap. Herr Frey left Dijon at 4:16 A. M., and reached Lyons at 7:43. Kimmerling arrived at Dijon at 5:21 A. M. and left there at 6:01. He arrived at Lyons at 8:16 and left there at 9:05. He had a lively race with Frey to Avignon, where Frey arrived at 12:05 and his opponent at 12:08 P. M. Kimmerling had gained 17 minutes in the 105-mile flight, as he started 20 minutes after the German aviator. At 5:15 P. M. Kimmerling, holding third place in the race, was obliged to land at Brignoles on account of motor trouble. Garros is reported as having borrowed a machine from Kuhling at Avignon, as his own was badly damaged. Vidart, when nearing Lyons, missed his way and landed at Grenoble, despite the fact that bombs were exploded to indicate the way. Legagneux and Hanriot started after him in their monoplanes and succeeded in overtaking and directing him back to the city. Gaget abandoned the race at Dijon, and Landron, on a monoplane, started from Buc Monday morning at 9:02 A. M. Lieut. Conneau had motor trouble at Brignoles and was obliged to descend. He resumed his flight at 2:45 P. M. and landed at Frejus *en route*. When he reached Nice he was at a great elevation, and, hearing some cannon shots and spying a fire in the center of the aerodrome, he was able to locate the latter and descend from the heavy rain clouds. He reported terrific and violent wind gusts at Frejus, where he was tossed about like a straw and was in constant danger of capsizing. He was flying at from 4,500 to 6,000 feet. At one time his motor weakened when he was combating the wind, and he was obliged to descend immediately and make repairs. An Italian aviator, Signor Mannisero, broke the guys of his Blériot when making a bad landing at Avallon, in the Department of Yonne. He attempted to repair his machine and resume his flight. Molla, between Dijon and Lyons, passed through a torrential downpour of rain which forced him to descend at Barbieny, near Chalons-sur-Saone. He started again half an hour later, but was enveloped in dense vapor caused by the brilliant sunshine after the rain. He struggled through the fog and finally made a violent descent on the race course at Villeurbanne, near Lyons. He was unhurt, although the wings of the machine were broken. Molla immediately attempted to repair his machine.

Lieut. Conneau of the French navy, who reached Rome first in his Blériot monoplane. He covered 900 miles in four days.

Roland Garros, who arrived at Rome only an hour and a half after Conneau.

Note the map holder and revolution indicator back of the hood of the monoplane.

THE LEADING AVIATORS IN THE PARIS-ROME-TURIN AEROPLANE RACE

Garros also had difficulty in his trip from Avignon to Nice. He fell near Penas with a heavy shock. The guy wires of his Blériot were broken and the wings damaged, but Garros managed to procure another machine and resumed his flight at 3:16 P. M.

The third day of the race, May 30th, Garros was the lucky aviator. He succeeded in reaching Pisa by nightfall, while Conneau met with a number of mishaps and was finally stalled at Alassio, midway between Nice and Genoa. Frey reached Genoa shortly after 6:00 P. M. He left Avignon at 5:31 A. M. and made an excellent flight to Nice. He continued on immediately and succeeded in reaching the Italian city. Lieut. Conneau spent most of the morning tinkering with his motor at Nice. He finally set out and steered straight for Genoa, but was compelled to descend at Alassio. He left Alassio in a violent wind, but after traveling a few miles only, he turned back and remained over night. Kimmerling remained at Brignoles most of the day endeavoring to get a satisfactory machine. He tried a new one and sent for two more to Lyons. Vidart arrived at Avignon after wandering far from his course. Bathiat, on a Sommer monoplane, was obliged to stop at Frolois, near Dijon, on account of a storm. Weymann abandoned the race.

Garros's flight from Nice to Genoa was a continuous ovation. He was saluted by bugles, cheers, and cannon shots, and when he reached Genoa the enthusiasm of the people was almost indescribable. The same was the case when he landed on the estato of the King, the Casine di San Rossore, at Pisa. The Frenchman was almost suffocated by the people, who covered him with flowers and carried him off on their shoulders in triumph. He said that he had experienced extremely stormy weather and had several times been in danger of capsizing. His physical condition after the long flight seemed to be good.

The morning of the fourth day, May 31st, Lieut. Conneau arrived at Genoa at 6:50 A. M. After breakfasting, he started at once for Pisa. Flying over the Gulf of Genoa, he overtook and passed the warship "Victor Emmanuel," whose crew saluted him. He arrived at Pisa at 9:10 without a mishap, but mistook the race course for the King's estate, and made a bad landing, hitting some of the hurdles. At 12:55, however, he had finished the repairs on his machine and was on his way to Rome. At Civita Vecchia he passed Garros, who was stuck there with a damaged machine. He arrived at Rome exactly three hours after he left Pisa. All Rome awaited him, and the telescopes in the Vatican observatory were the first to pick him out. He received a tremendous ovation, being picked up by the people and placed in an automobile beside the Mayor and the Prefect of Rome amid great cheering. The people even pushed the automobile along the streets. After delivering his message from the President of the Municipality of Paris to Mayor Nathan of Rome, Conneau was overcome with emotion at his reception.

M. Garros secured an early start from Pisa, but at Civita Vecchia he met with a mishap, when only forty miles from Rome. The machine was flying at a tremendous pace when it suddenly dove to the ground and was badly wrecked. He finally succeeded in repairing it, and he reached the Eternal City at 5:30 P. M.

Herr Frey reached Pisa early in the morning, but wrecked his machine when alighting on the race track instead of the field where it was expected he would land. Lieut. Chevreau, who was one of the officers detailed to make the first stage of the flight from Paris to Nice, came to grief at Cuisery, near Lyons. He returned to that city in an automobile to secure new parts for his machine. Lieut. Lucca, who was flying with a passenger, reached Lyons in the morning of the fourth day, after covering 135 miles, it is said, at 74½ miles an hour.

The fifth day, June 1st, M. Vidart flew from Nice to Genoa in a trifle over three hours. He continued on to Pisa, which he reached without mishap. From Pisa he forged ahead toward Rome, but was compelled to land at Cecina, after traveling only 35 miles. The left wing of his machine was broken in alighting. He was not hurt, but was obliged to return to Pisa for a new machine, which he hoped to procure in time to finish his flight to Rome on June 3rd. Kimmerling collided with a tree just as he was leaving Brignoles for Nice in the early evening of the fifth day. His machine was damaged and it is probable

(Continued on page 578.)

Waterspouts

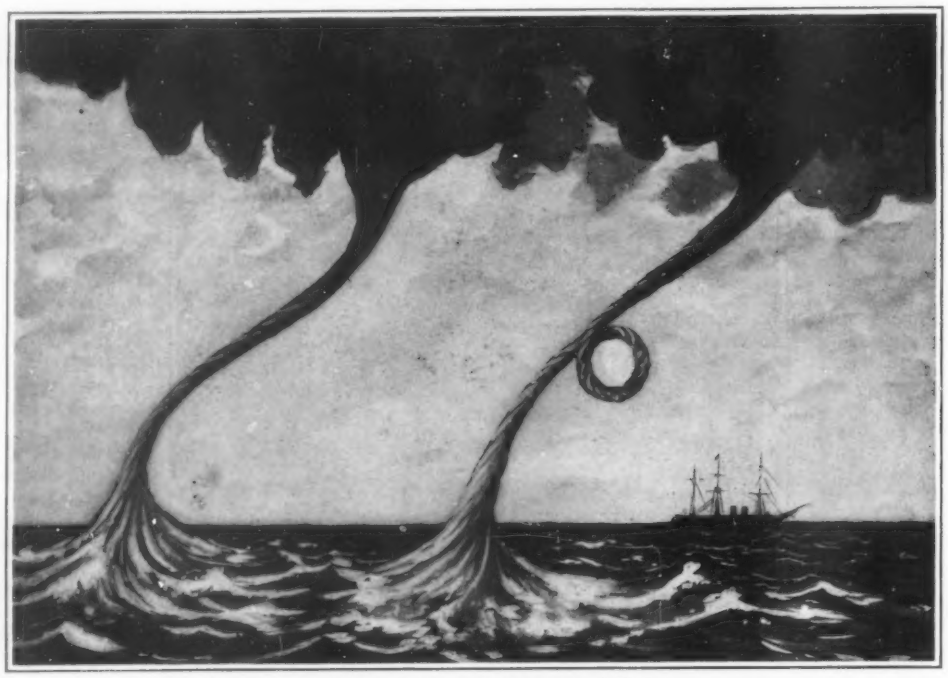
Facts and Fictions Concerning Them

IN the waterspout the mediæval mariner saw a malevolent living monster—a "sea dragon."

El Masudi, writing in 954 A. D., thus records the beliefs current in his day: "There are *Timmins* (dragons) in the Atlantic seas. Some believe this is a wind arising in a whirling column from the bottom of the sea. Some say it is a black serpent rising in the air, and succeeded by a terrible wind; some say that it is a terrible animal living in the bottom of the sea; some say they are black serpents, passing from the desert into the sea, and living five hundred years. Abbu Abbas says they are killed in the clouds by cold and rain."

There were various means of combating them. Once all sailors carried black-handled knives, which the monster was believed to hold in special abhorrence. When a spout made its appearance these knives were produced and pointed in its direction, waved in the air so as to make the sign of the cross, or, according to the recommendation of certain contemporary authorities, driven several times into the side of the ship. Certain passages from the Gospel of St. John were recited as charms against waterspouts. A loud noise of any kind was also believed to be efficacious against them; shouts, the clash of swords, the beating of drums and gongs, etc. The custom of firing cannon against waterspouts dates back at least as far as the sixteenth century, as it is alluded to by Camoens, in the "Lusiad" (1572). The original idea appears to have been to frighten them away by the noise of the report; but in later times it was believed that the watery column could be cut in twain by the cannon ball, and the spout thus dissipated. It would be interesting to know whether the cannonading of waterspouts is still sometimes practised. It was certainly common much less than a century ago. It is hardly necessary to say that it is entirely futile.

Many misconceptions concerning waterspouts are still widely prevalent, and these are kept alive by the loose and inaccurate statements to be found in many professedly authoritative scientific works that touch upon this subject. For example, one commonly meets with the statement that the waterspout (like its terrestrial congener, the tornado) is precisely analogous to the widespread cyclone, or "low," on the one hand, and to the tiny whirl of dust, dry leaves, and the like over hot dry ground, on the other. This statement is misleading. All three phenomena are, to be sure, vortices in the atmosphere, and inequalities of temperature are their primary cause; but the immediate forces at work in producing them are quite different. The great cyclones of middle latitudes—i. e., systems of winds revolving around centers of low barometric pressure, and extending over areas of hundreds or thousands of square miles—are episodes in the eastward whirls of the whole atmosphere around the poles of the earth, and are evidently not due to excessive heating of the ground beneath them, since they are more frequent and more intense in winter than in summer. Just how they are produced and maintained is one of the great moot questions of physics and meteorology. On the other hand, the little whirls so often seen on a dusty road, for example, result from an unstable condition of the air immediately over the ground. On a warm sunny day the ground becomes intensely hot, and heats the lower layer of air by conduction. If the air as a whole is tranquil, this layer may remain undisturbed for a time, constantly growing hotter, until at some particular point it suddenly upsets—upward—i. e., rushes up to its natural level, in accordance with law of gravity, above the colder and denser layer to which the ground had not imparted its heat by conduction. At the surface of the ground the air flows in from all sides toward the point where upward movement is in progress; a point that may be compared to the vent at the bottom of a wash basin discharging its water. Local (so-called "accidental") circumstances prevent the inflowing air currents from being exactly convergent, and a central whirl or vortex is the result. In a cyclone the rotation of the wind around the vortex is always from right to left in the northern hemisphere, and *vice versa* in the southern, because the inflowing currents are deflected in a constant direction by the rotation of the earth. In the dust whirl the paths of the air currents are so short that the deflective effect of the earth's rotation is insignificant in comparison with the local effects of topography, etc., and hence these whirls turn sometimes to the right and sometimes to the left, in the same hemisphere. From the foregoing paragraph it will be seen that the dust whirl and the cyclone are by no means identical phenomena, differing only in magnitude. What shall we say of spout phenomena?



Waterspouts off the coast of New South Wales.

(After Russell.)

The latter term includes waterspouts, landspouts, and tornadoes. In French they are all called *trombes* (from the Italian *tromba*, a trumpet, or the Spanish *trombo*, a top, in allusion to their visible form). There is no essential difference between the waterspout and the landspout; in both the visible "spout" is a mass of water vapor, the condensation of which is due to the expansion of moist air under the diminished pressure within a vortex in the atmosphere; but in the landspout this vapor is mingled with dust and other terrestrial objects sucked up by the spout from the surface over which it passes. The term

(*Continued on page 577.*)

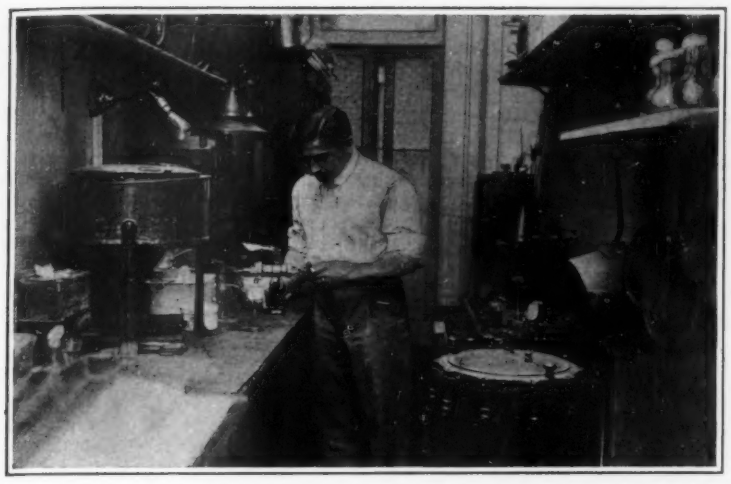
A group of waterspouts on the Mediterranean.

Observed by Capt. Cabbage June 27th, 1827. From a contemporary lithograph. (Reproduced in *Das Weltall.*)

"Mad Dogs" and Hydrophobia

Rabies Before and After Pasteur

By John B. Huber, A.M., M.D.



Preparing the emulsion for the inoculation of sheep to be immunized against rabies.

Administering the Pasteur treatment at the New York Pasteur Institute.

IN order to appreciate justly the mighty (though silent and bloodless) revolution that had its inception in the genius of Pasteur, one must compare the human sufferings endured through the ravages of diseases which he demonstrated to be preventable with the alleviation of such suffering that has been achieved since his day. All the world's great scourges—smallpox, cholera, bubonic plague, malaria, yellow fever, tuberculosis, meningitis, diphtheria—how wonderfully have their terrors been mitigated; how obvious is it now that such diseases can be eliminated from human experience if the pillar of fire that has been raised by the science of Pasteur and Koch should be but steadfastly and faithfully followed.

Rabies, or hydrophobia, is one of these infections—and among the most dreadful because of the intensity of its symptoms. However, as compared with other ills to which man is subject, it has fortunately been rare in human experience. On this account it has been given rather less attention than those diseases which have in the past decimated cities and wiped whole towns and villages out of existence. And yet a consideration of hydrophobia is, apart from its tragic features, of peculiar interest, since it was the first disease upon which Pasteur worked, in the evolution of the principles of prophylaxis which are now the firmly established ground work of all preventive medicine. And to the memory of Dr. Paul Gibier, who established the Pasteur Institute in New York city, and to Dr. George G. Rambaud, its present head, is due acknowledgment for the introduction of the prophylactic treatment of rabies in this country.

Pasteur, who discovered the modern method of treating hydrophobia.

How effective is such prophylaxis? Look first into the past.

Hydrophobia is as old as human history. From the mass of material on this subject, we note that Lusruta nine centuries before Christ described how dogs, jackals, foxes, wolves, bears, tigers, became rabid, foaming at the mouth, which remained open, saliva flowing from it; "their tails hang down; they do not see or hear well; they snap and bite at one another, and thus communicate the malady to their fellows." Plutarch (admittedly not the most scientific of observers) relates that rabies was first observed in men in the days of the Asclepiadæ, the earliest known physicians. Homer described Hector as a "raging dog." That fable about Actaeon having been torn to pieces by his own dogs at the behest of the chaste Diana, would seem to need revision in the light of modern science; probably the hunter was torn to pieces, but this by reason that his dogs had turned rabid. At least a dozen ancient writers referred to rabies. Democritus (the laughing philosopher, who traveled extensively) not unnaturally con-

Examining under the microscope stained slides made from pieces of the brain of a dog suspected of rabies.

Sheep immunized against rabies at the New York Pasteur Institute.

Dissecting out the special portion of the brain of a dog to be examined under the microscope.

INCIDENTS IN THE HISTORY AND PRESENT PRACTICE OF PASTEUR'S TREATMENT FOR RABIES

founded rabies with tetanus. In 1271 there was a very notable epidemic of rabies in which many French and German shepherds suffered. Many in Spain endured and died of tortures exceeding those of any Inquisition, about 1500. In 1712 the Hungarian woods were infested with rabid animals. In 1719 to 1762 there were numerous epidemics of rabies (in which women and children suffered most cruelly) throughout all Europe. Fife, in Scotland, was in 1748 notoriously infested with mad dogs. In 1752 there were many mad dogs about St. James, London.

In 1768 the people of Boston suffered much by reason of rabid dogs and foxes; as also in Philadelphia and Maryland in 1779. From 1785 to 1789 there was much canine rabies in the United States; from 1803 to 1830 this disease was pandemic in many parts of Europe and America. In Prussia from 1810 to 1819 there were recorded 1,635 human victims, most of whom had been attacked by rabid wolves; in Prussia, from 1820 to 1854, rabies claimed 1,073 victims; between 1830 and 1847 there were in Austria 1,038 human victims of hydrophobia. From 1855 to 1860 the disease was common in England, North Germany, France and Spain; Bavaria had every year from 1867 to 1873 800 cases in a total of 275,000 dogs. In 1869 the disease was rife in Paris; from 1879 rabies prevailed in the North of England up to 1881 by reason of insufficiency of police measures. In France, between 1854 and 1860, the human deaths from rabies numbered 1,000. For New York city there is the following tabulation by years of hydrophobia mortality:

Year.	Deaths.	Year.	Deaths.
1855	4	1865	3
1856	3	1866	2
1857	2	1867	4
1858	0	1868	1
1859	2	1869	5
1860	0	1870	3
1861	5	1871	7
1862	1	1872	6
1863	3	1873	0
1864	1	1874	5

Tardieu and Borley, in France, collected 855 cases, of which 399, or 46.6 per cent, died. This was before the Pasteur treatment by inoculation. Let us consider now the hydrophobia status since such inoculations were begun.

True hydrophobia is increasing in the United States, mainly by reason either of the absence of laws on the subject or of the laxity with which existing laws are enforced. Taking the country all in all, our preventive measures are altogether inadequate. If we take the experience of recent years for a criterion, we shall find epidemic rabies manifesting itself with the coming of warm weather. And there are very likely none of our States that have not a few cases of rabies among dogs at all times. The disease is probably endemic in the Arctics; it seems to be frequent among Alaskan dogs. Our Pacific coast is considered to have been exempt until recent years; there are now cases in San Francisco, which are said to have had their origin in some rabid dogs brought from the East. Isolated cases of human infection have been observed in all sections of the Union.

In these respects we compare unfavorably with Europe. England has a muzzling order—which, by the way, she enforces; in consequence the disease has completely disappeared in that country. And in matter of fact North Germany, where a qualming zoophilia gets scant sympathy, the enforced muzzling of dogs has resulted in the practical elimination of rabies. There, also, as in England, animals demonstrated to be infected are destroyed. In Berlin rabies was common prior to 1875; since that year a law has been enforced requiring the killing of dogs suspected of rabies, and the muzzling and leading of dogs when in public places; there have been no cases of rabies in that city since 1883.

Dr. G. H. Hart, of the Bureau of Animal Industry, Washington, D. C., has found the number of rabid dogs to be increasing. The frequency of hydrophobia in and about Washington has of recent years become alarming. In 1907 a positive diagnosis of rabies was made in 44 cases, in 33 of which the dogs had bitten 16 people, in 46 others dogs and two cows. And this is fairly typical of the general status of the disease in America. Dr. Hart has well observed: "Many dog lovers cannot appreciate, or are indifferent to, the anxiety, mental terror and suffering of several thousand human beings in our country yearly, and the actual death of from one to three hundred yearly, not to mention the suffering and death of countless dumb brutes. But as soon as a muzzling law is passed owners of dogs are up in arms, using their time, influence and money to secure its repeal, or prevent its enforcement, on the ground of alleged cruelty."

There is certainly an unfortunate tendency among many citizens to deprecate the importance of hydrophobia, on account of its comparative rarity. However, the importance of a disease should be estimated not by the number of its cases, but by its gravity and virulence. There are again some misguided people who deny altogether the existence of such a disease as hydrophobia. No doubt not a few animals—and some of them valuable, though in no proportion to the human lives placed in jeopardy—are unnecessarily destroyed in the frenzy of popular excitement that accompanies an outbreak of rabies, and which is much aggravated by the erroneous notions of the way a rabid dog behaves.

A homeless mongrel is worried and kicked about by a gang of toughs; this, with the heat, the dust, the noise, the starvation and what not else, sends the poor beast scurrying through the streets. Let this pitiable creature in self defense bite some one, and forthwith a "mad dog scare" is in full sway. The vicious animal is then duly shot or battered to death. How far better a fate than this were the laboratory for stray and homeless and ownerless dogs, where these unfortunate "companions of man," if unclaimed, would be put out of existence by humane methods.

All dogs which run amuck are not necessarily rabid any more than all oddly-behaved human beings are demented. Yet the disease is by no means so rare as to be negligible. The Society for the Prevention of Cruelty to Animals has reported that its agents have been bitten 15,000 times without the development of a single case of hydrophobia among them; but this should not argue the absolute non-existence of rabies. Such agents are, by reason of their experience, able to distinguish between a peevish dog and a mad one.

Again, fear of the consequence to persons bitten by non-rabid dogs is apt to develop false hydrophobia—lyssophobia—which, although it is not fatal, is nevertheless likely to cause much suffering. The manifestation is here purely neurotic or hysterical. A nervous person bitten by either a rabid dog or one supposed to be may develop within a few months symptoms somewhat resembling the true disease. There is irritability and depression; the patient feels his condition to be serious, and that he will inevitably become mad. He may have paroxysms in which he says he is unable to drink, grasps at his throat, and becomes emotional. The temperature is not elevated, as in true rabies, and the affection does not progress. It lasts much longer than true rabies, and is amenable to treatment. Most of the cases of alleged recovery of rabies have undoubtedly been pseudo-hydrophobia. But for the prevention even of this condition, if for no other reason, it is imperative that the true status of every dog which has bitten a human being should be determined.

Rabies is supposed to have originated with the canine family—the dog, the fox and the wolf; it occurs in cats, horses, cattle, pigs, rats, foxes, jackals, skunks, etc., probably in the first instance by the canine's bite; most animals are susceptible; the virus is communicated by inoculation to the rabbit, horse, sheep and pig. In the Western States the skunk is considered very liable. Even from the bites of rabid animals but 16 per cent at most of the cases are considered to develop true hydrophobia. The remainder escape, owing to the protection afforded by clothing, which absorbs the saliva and the virus before the flesh is wounded, or on account of the slight extent of the wound or the virility of the natural antibacterial forces. The chief protection of the victim, however, in most cases resides in the fact that a nerve has not been severed or lacerated by the bite. Besides, Paltauf has demonstrated by autopsy on persons fatally bitten by rabid animals that the virus ultimately reaches the central nervous system; evidently the virus is there in many cases destroyed, without the development of rabid symptoms, by the natural defensive forces, which are reinforced by the immunizing principle in the Pasteur treatment. Another factor, upon which death or recovery may depend, is the difference in the virulence of the poison; for example, the bites of rabid wolves cause rabies in about 6 per cent of those bitten, as against 6 to 9 per cent of fatalities from dog bites, and no deaths from subcutaneous inoculation of attenuated rabbit virus.

The danger is greatest when exposed parts are bitten. Freshly shaven skin allows penetration of the virus, a most important fact with relation to the filthy habit of letting a dog lick the face. So dreadful is the disease and (when it has passed the incubation stage) so invariably fatal, that the commonest of common sense imperatively commands that precautions be taken.

If a bite is received from a suspected animal, a physician must be summoned immediately. The older first aid method of sucking such a wound is obviously objectionable; a better way is if possible to substitute the mechanical suction apparatus. The wound must immediately, after excision of the ragged edges, be cauterized with caustic potash or concentrated carbolic acid; but even beyond twenty-four hours this measure may avail. In view of the anxiety natural under the circumstances, we should cauterize, even if the diagnosis of true rabies is not positively assured. The inconvenience is negligible in the circumstances; and the injection of cocaine in and about the wound should make the operation practically painless.

What proceedings are to be followed regarding the suspected animals? Boards of health should have authority to require all suspected animals to be turned over to them for observation; and they should provide a place where such animals may be observed until death or recovery. On the death of such an animal its head should be sent at once to a competent pathologist or to the nearest health department. Or its skull should be broken open, the brain and medulla removed, and placed in a jar containing alcohol and water, half and half; and this specimen may then be sent to the laboratory, where within five minutes the presence of the characteristic lesion may be demonstrated. A rabid animal should not be killed if it is practicable to confine it; but should preferably be allowed to die a natural death. The development of the disease might make the diagnosis certain in cases when, if the animal were killed immediately after the bite, even microscopic examination might be inconclusive. The presence in the brain and spinal cord of the "Negri bodies" is positive evidence of rabies; but their absence does not necessarily negative the diagnosis. Hydrophobia is, with scarlet fever, measles, smallpox, yellow fever, infantile paralysis and other affections, in the class of unquestionably infectious diseases, the specific causes of which have not as yet been demonstrated absolutely beyond question. In man the incubation period (during which the disease remains latent and without manifestation) is from a fortnight to several months, or less in young persons. True hydrophobia is said to have developed thirty-eight months after a bite.

Immediately rabies is demonstrated in the dog which bit the human patient, the latter should at once undergo the Pasteur inoculations. This is a procedure scientifically as well established as that of vaccination against small pox. As a result of the Pasteur treatment, in 26,000 cases thus treated in Paris from 1886 to 1901, less than 1 per cent died of hydrophobia; a like ratio has obtained in New York and other places. In 1908 it was reported from Kassauli, in India, that of 1,898 people treated with Pasteur injections, there was failure in 0.36 per cent of the cases; of 108 people bitten by supposed rabid dogs, and not subjected to the Pasteur treatment, 44 died; of 154 persons bitten by supposedly rabid jackals, and not subjected to Pasteur inoculations, 48 died. The occasional failures are undoubtedly due to the fact that the treatment is not promptly administered; its beneficent effects are rendered possible only by the fact that the average incubation period of rabies is relatively long.

Dr. Q. M. Stimson, of the United States Public Health and Marine Hospital Service, states that the Pasteur treatment may be obtained from the surgeon-general of that service, on application by health officers having moderate laboratory facilities for administering under their supervision. There are, moreover, some twenty institutions in the United States in which the Pasteur treatment is available; a list of these is given in the publication, "The Prevalence of Rabies in the United States," by the United States Public Health and Marine Hospital Service, Washington, 1909.

The Current Supplement

AMONG the more noteworthy articles of the current SUPPLEMENT, No. 1849, may be mentioned Dr. Alfred Gradenwitz's description of an attempt made by Dr. H. Nathusius to combine the advantages of the Héroult and Girod electric furnaces for steel making, and Mr. Edward M. Hagar's paper on the utilization of the wastes of a blast furnace.—Mr. Henry Harrison Suplee explains the various methods of determining the height of aeroplanes.—The processes of sugar refining are disclosed by W. D. Horne.—The Bureau of Manufactures of the Department of Commerce and Labor will soon issue a monograph on packing for export, which, from the viewpoint of the exporter, is one of the most important publications ever issued. An abstract is published.—Prof. Sir J. J. Thomson recently delivered a series of lectures on radiant energy and matter. The first instalment appears in the current issue.—Other articles are "Carbureters and Vaporizers," by T. A. Borthwick; "The Lost Arts of Chemistry," by W. D. Richardson; "Automatically Drawn Curves," by Albert A. Somerville, and the usual miscellaneous notes.

Col. George Washington Goethals, Canal Builder

By William Atherton DuPuy

WHEN, in February, the fight in Congress as to whether or not the Panama Canal should be fortified was nearing its close, Lieut.-Col. George Washington Goethals, who is in charge of the work on the isthmus, was called to Washington. Congress wanted to ask its most responsible engineer if the scheme was practicable. He answered simply in the affirmative. He was asked if he would be able to undertake the task of building the fortifications and the living quarters for the troops if Congress approved of the plan. His answer was another simple affirmative. When asked if the assuming of this additional task would retard the work on the canal, he said that it would not.

Upon these assurances Congress proceeded to authorize the proposed fortifications. Congress has unbounded faith in Col. Goethals. No one doubts that the fortifications will be in place when the first ship passes through the great waterway. Yet the task is no mean one. Upon it is to be spent a minimum of $12,000,000. Living quarters are to be built for 6,000 troops. Coast defenses are to be constructed on both sides of the isthmus that will rival any such works in the world. Their guns will be able to destroy any battleship that comes within ten miles of the mouths of the canal. Land defenses are to be built to repel any invading force that might be put ashore. The whole scheme of defense is to be such that its carrying out would be sufficient to make the reputation of any engineer who was assigned exclusively to the task.

But to Col. Goethals it is to be but a side line. He has other tasks that are beyond compare in anything doing the world around. The building of the Panama Canal is the greatest engineering feat of the age, perhaps of the ages. This has been remarked so often that it has become a platitude. But it is magnificently true. The man who is building the canal bears upon his shoulders such responsibilities as few men have borne since time began. Let us look into a few of the details for which he is responsible.

There is the matter of keeping the canal zone sanitary. Without never ceasing vigilance disease would steal in and sap the vitality of the entire force. Cows may not be kept on the zone because cows make tracks in muddy weather, tracks hold water, and standing water breeds mosquitoes. Sewerage is installed everywhere, pools are drained, brush is cut. There is a string of hospitals across the isthmus that provide everything that modern science can devise for the ailing. The sick and death rate in the zone is lower than in most of the cities of the States, but Col. Goethals refuses to allow undue credit to be given for this, for, he states, the people on the isthmus are all in the prime of life.

In the zone justice is administered in a way that ignores the customs followed in the States. Matters are expedited. There is no place for a complaint against the law's delays. Col. Goethals has developed a system of getting immediately at the justice of any case. The cumbersome jury trial method is resorted to only in cases where the death penalty or life imprisonment is involved. Summary justice rules. There is dispatch, immediate action. No community in the States handles these matters of law in half the time they are handled in the canal zone.

A system of recruiting labor has been built up that works itself. There is never a dearth of labor on the isthmus. From all over the world the workers come. Spaniards, Italians, French, Americans, West Indians, 35,000 of them in all, serving the same master. The stream was at first started by recruiting officers who brought a few men from many points. Then the laborers were well treated. They wrote home for their brothers and friends. An endless chain was formed. And still they come. There is no labor trouble. Col. Goethals claims that he has gotten together the best working force in the world. The force claims that it has the best big boss on earth.

Then there is the commissary which supplies everything that these 35,000 men and their families eat and wear. There is not a meal supplied on the zone, from luxury at the Tivoli to the three meals a day for thirty cents that are provided for the West Indians, that does not depend on the commissary. It is no small commercial undertaking to administer such a venture. Yet this falls directly under the care of Col. Goethals.

Then there is the real task under the department of construction and engineering that is the great central idea of them all. The zone is divided into three divisions, each in charge of a division engineer, two army men and one civilian. There is the great Gatun locks and dam on the Atlantic side, the Culebra cut in the middle section and the locks at Pedro Miguel and Miraflores and the channel to the Pacific. Any one of these divisions has a monstrous work to perform. In connection with the excavation at Culebra the operation of trains in disposing of the dirt is in itself the task of a great engineer. Yet all these things, even the detail of them, are under the direction of one man, a man who has not yet enough work and is willing and anxious to take on more. For Col. Goethals is a *gourmand* for work. When Col. Goethals took charge of the Panama proposition early in 1907, the machinery had been pretty well completed for the work. There is no man who gives John L. Stevens, the former chief engineer, more credit than does Col. Goethals.

"Mr. Stevens," he is prone to tell the interviewer, "is responsible for the success of the undertaking. He laid down the big plan. I am but following in his wake."

"But," the interviewer may protest, "you have changed many things from the lines that were followed by Mr. Stevens."

"So would Mr. Stevens have made many changes had he remained in charge," will the colonel answer.

It is the modesty of the man that thus attempts to stand out of the spotlight and give others the credit. As a matter of fact there had been much excellent preparatory work done before Col. Goethals took charge. But the actual work of digging the canal had hardly begun. The present chief engineer is the man who is the actual builder of the big ditch.

Col. Goethals is equally modest when enthusiasts pyramid praises of the great engineering accomplishment on the isthmus. The colonel insists that it is not an engineering task that he has in hand. It is merely a matter of administration. He holds that he has but to keep the machine going and that the task will accomplish itself. He succeeds in convincing no one but himself by this argument, but such is his actual view of his position.

When Col. Goethals took charge of the canal building he did so in the face of a strong prejudice against him because of the fact that he represented the military branch of the government. The work was being done by civilians, and these are always prejudiced against military methods. They object to the iron hand, to formality, to clockwork routine. The men on the job were loud in their protest against transferring the work to the men in the army.

Col. Goethals realized this. He particularly avoided any show of military discipline. Mr. Stevens had placed the different divisions of the work under given engineers and had instructed those men that they were responsible for the detail that fell within their jurisdictions. Col. Goethals, on the contrary, took over a vast amount of detail all along the line. There is nothing too small to occupy his attention. Every day he walks over a third of the canal route. He starts at seven o'clock in the morning with the gangs of laborers. He trudges over the works until near noon. Then he gets aboard his car, which is a cross between an automobile and a hand car, and returns to his office. The afternoon is given over to the administrative detail. Often much of the night is given to the same work, for the man is absorbed with his great task. It is his life.

This is a way that the big work has of gripping men. There is no laborer from the West Indian mucker to the American engineer who is not enthused with the contemplation of the bigness of the thing which they are doing. The job is their life. It is a case of the oft repeated theory of the spirit of the man at the head of any enterprise permeating all those that work under him. The whole force has the Goethals brand of enthusiasm.

But in all of this there is little of the military in the manner of handling this civilian task. There is no better example of the lack of military methods and the assumption of unlimited detail of administration than the complaint day that Col. Goethals set aside when he first went to Panama and which he has maintained ever since. On complaint day any man, woman, or child between Panama and Colon may come to the colonel's office and tell his troubles. Sunday is complaint day. Then the whole force is off work and has its leisure. It can tell its tale of woe. Its story is listened to, and if there seems justice in the complaint something will be done in the matter. Col. Goethals is sympathetic and diplomatic. Often the mere telling of the tale gives the necessary relief. Often there is something that should be remedied. Often there is gotten a tip that leads to better administration.

One day a railroad engineer came to the colonel with a serious kick. He was being discriminated against. He was being made to haul eighteen cars. The other engineers were pulling but fifteen. He was asked if he could successfully pull his eighteen cars. He said that was all right, but it was the discrimination that he objected to. The colonel promised to so adjust matters that he would be placed at no disadvantage. Next day he issued an order that all engineers should pull eighteen cars.

"We are for him," said a great, hulking steam-shovel man to me the other day. "When the colonel comes along on an inspection tour he greets each band of workmen with a cordiality that makes them believe that they are the especial object of his affection. They feel that they are in with him on things. As a result they redouble their efforts when he has passed, feeling that they are not merely working for a living, but are working for the colonel."

The building of the Panama Canal is to-day a demonstration school to all the world. There is not a day that it is not visited by scores of men from all parts of the world who are interested in engineering. Many of these men are the greatest engineers in their given countries. When the work is completed there will probably be few big engineers who have not seen and studied the manner of it. The eyes of the world are on the job, and the lessons being laid down by the man who is accomplishing it are to be emulated the world around.

There is no lack of appreciation of the import of the task on the part of Col. Goethals despite his modesty with relation to it. He realizes that it will stand a monument through the ages. He realizes that its success will lead the engineers of the world to undertake things that have hitherto appalled them. He realizes that the ships of the world will constantly ply through this waterway and that its lessons will be constantly brought home to the world. He knows, for instance, that the example in sanitation that Panama has furnished will go down through the ages as a demonstration of the possibilities of such work in the tropics. He knows that all the equatorial countries of the world are here being positively shown that the burden of disease and death under which they have always labored is unnecessary and that they may be made healthy as Panama has been made healthy. This great, humanitarian influence of the canal is recognized as one of the biggest things being accomplished in thus linking ocean with ocean.

Two years ago Col. Goethals stated that the canal would be completed on schedule time, that is by June 1st, 1915. This statement was taken as final and all preparations have been making to that end. While still holding to the original official statement, the engineer in chief now says privately that the waterway will be complete December 1st, 1913, thirteen months ahead of time. This leaves a good latitude for the elimination of any difficulty that may arise when the water is actually let into the canals and the locks. There are still a few such possibilities as slides into Culebra, but the worst of these may be easily met with no great delay.

Col. Goethals is a tall, strong-limbed man, fifty-three years old. He is gray, curly-haired, good looking. His health is of the best, and work is but a stimulant to him. With him on the canal zone lives his wife. Their comfortable home is at the top of the divide near Culebra. It was built before he went to Panama, and is probably much more elaborate than he would have built had the creation of his quarters been left to him.

With the colonel and Mrs. Goethals at Panama is now their eldest son. This son graduated from the United States Military Academy some four years ago at the top of the most difficult of the classes, that of engineering. He is following in the wake of his father. He is now stationed at Panama as a student engineer. The second son is now a junior at Harvard and has elected not to follow the army as a calling. This is the extent of the Goethals family.

Col. Goethals was the chief engineer of the army during the Spanish-American war. He had carried forward much of the important engineering work of the army for a decade before his appointment to his present post. Among his most important tasks was the building of locks and dams in the Tennessee River at Mussel Shoals for the improvement of navigation. He was a poor boy to begin with, and was appointed to West Point from Brooklyn by "Sunset" Cox. He has made good ever since.

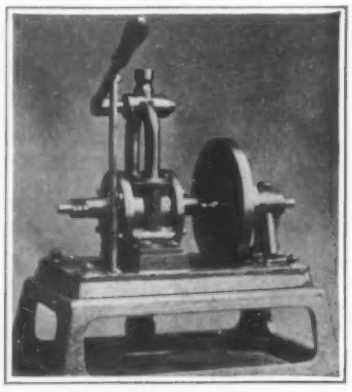
[The Editor of Handy Man's Workshop will be glad to receive any suggestions for this department and will pay for them, promptly, if available.]

Design for a Small, Reversible Rotary Steam Engine

By A. J. Jarman

IS it possible to construct a practical and efficient rotary steam engine? is a question that has often been asked by persons who possess a good turning lathe and other mechanical tools, and who are themselves good mechanics. The general run of rotary steam engines are complicated, and it would tax the skill of a good mechanician to construct one. The description here given will enable any one to construct a small rotary engine that is simple, powerful, and efficient.

A six-vane rotary engine with cover plate removed.



General view of the three-vane rotary engine.

Two such engines were constructed by the writer several years ago, one with three vanes, the other with six vanes, as the drawings and photographs will show. The three-vane motor, when worked with steam at a pressure of twenty pounds to the square inch, ran at a speed of 520 revolutions per minute, giving exactly one mechanical horse-power upon a Prony brake. The consumption of steam was not extravagant, and when running at this speed it could be reversed quickly by simply lifting the handle of the steam valve up or down, so as to throw the inlet and the outlet valves at the same time.

The feed valve and the exhaust valve consisted each of a two-way cock with short levers attached to the plugs, and connected by a steel rod, as shown in both the sectional drawing and the photographs. The motion of the engine was extremely steady, presenting the appearance of an electric motor rather than a steam engine.

FIG.1.

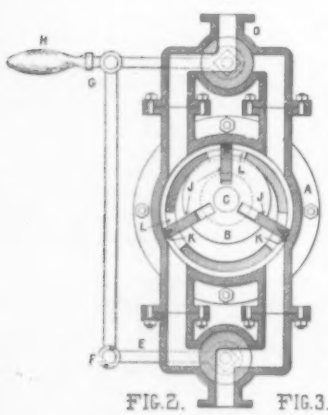


FIG.2. FIG.3.

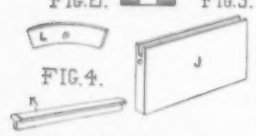


FIG.4.

Sectional view of the three-vane rotary engine.

The six-vaned motor gave no advantage over the three-vaned one. In fact, its efficiency tests were much lower, while the three-vaned motor could be worked by water pressure as well, and could also be used as a pump for water, oil, gas, or air.

The engine can be built in any size to meet the requirements of the builder. The three-vaned engine here illustrated had a cylinder bore of 4 inches, while the six-blade engine had a 6-inch bore. Fig. 1 represents the engine in section. *A* is the cylinder, in which the roller *B* revolves. The axle is fitted at *C*. This roller, with its three slots to receive the vanes, is mounted eccentrically with respect to the main cylinder. In the case of this one horse-power motor, it was one inch out of center. The roller revolved against the top of the cylinder, to keep the steam from passing at this point, thus preventing back pressure upon the vanes. The two-way entrance valve is shown at *D* and the two-way exhaust valve at *E*, coupled to the inlet valve by a rod at *F* and *G*.

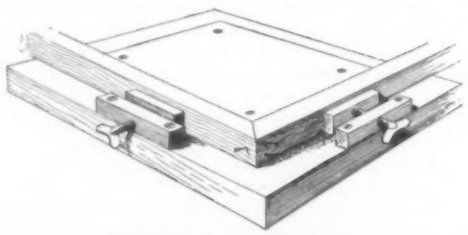
By tracing the movement of the handle *H*, it will readily be seen how the inlet and outlet are changed, thus giving a reversed motion. The cylinder ends have a groove cut in them, so as to receive the metal segments shown at *L*, Fig. 2, which fit flush with the cover. These segments are the guides which rotate with the vanes to which they are pivoted, while *K* is a piece of T-metal fitted into the top longitudinal groove of the steel vane *J*, Fig. 3, with a steel spring at the base to press the T-piece against the cylinder. This T-piece is in fact a metallic packing. It will be observed that the vanes perform a perfect circle, the inward and outward motions being brought about by the eccentric mounting of the slotted roller.

The photograph of the completed engine shows a cast-iron foundation, so arranged that the two-way exhaust valve stands free. This is necessary to make the engine complete in one piece, so as to be self-contained. The T-pieces are shown fitted in position in the photograph of the six-vane motor, the pressure spring being simply a curved strip of steel. The T-pieces of the three-vaned motor were made of cast German silver, the cylinder being gun metal. If constructed as a water motor, the outlet should be much larger than for steam.

Picture-framing Outfit

By Glenn W. Persons

THE Handy Man's Workshop is not complete without a picture framing outfit. A device for holding the molding while nailing and gluing which is practical can be easily made as follows: The clamps can be secured from the tops of two old clothes wringers by sawing about three inches on either side of the screw. The base of the device should be a 2-inch hardwood plank, or better still, two pieces of inch board glued together with the grain of one running at right angles with that of the other. The size of the base ought to be 18 by 22 inches. A board 6 by



Handy picture-framing clamp.

8 and ½ inch thick should be glued and screwed to the base as shown in the illustration. Bolt the clamps to the base as illustrated, leaving sufficient space between the ends of the screws and the holding board to place the widest molding which one would use for any frame. This space must not be too wide, for the screw has a tendency to spring up when heavy pressure is applied. Small blocks are to be used when narrow molding is being held, or on any molding which the end of the screw would dent. The difficulty in making frames is in holding the pieces firmly together while nailing. With a little practice as good a joint can be made on this machine as with a bought device, if one has a true miter box.

How to Prevent a Small Drill from Breaking

By G. A. M.

WHEN it is necessary to drill small holes in hard metal with a hand drill, it is often a difficult matter to prevent the drill from breaking. The pressure required to make the drill cut is often so great that the drill is unable to withstand the strain, and it snaps off like glass. To prevent it from breaking take a round piece of wood, preferably hard wood, about ½ inch shorter than the projecting end of the drill when in the chuck. Drill a hole lengthwise through the center with the drill and the device is then ready for use, as shown in the accompanying

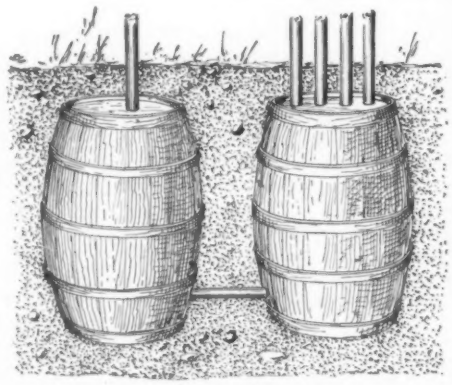
Reinforcing for small drills.

sketch. If necessary to drill the hole more than ½ inch deep, when the wood begins to strike the metal you can cut off as much more as is required. The wood reinforcing stiffens the drill so that it will withstand three or four times the usual pressure.

Underground Engine Muffler

By Harry E. Wells

MANY farmers and mechanics have gasoline engines which are objectionable on account of the noise from the exhaust. This noise may be entirely done away with by the use of the simple muffler pictured herewith. Two barrels are connected by a pipe of the same size as the pipe that leads from the exhaust. Four small pipes are screwed into the top of one barrel, and the exhaust pipe is fastened in the top of the other. Both barrels are buried so their tops are about six inches below the surface of the ground. This muffler will stop the noise entirely, and on account of its size, it will not reduce the power of the engine, which the smaller ones have a tendency to do.

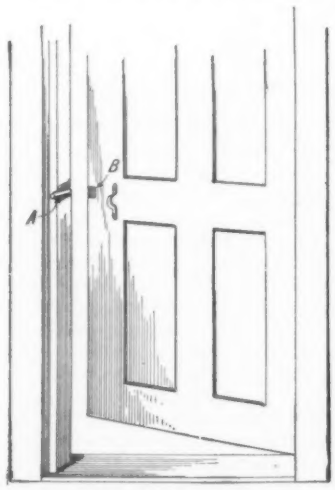


Underground engine muffler.

Magnetic Door Stop

By H. F. Williams

THE sketch published herewith shows a magnetic bar used for holding a door shut. The object of this arrangement is to eliminate the use of the small door latch on inside doors, and thereby to save time in opening and closing the door. The device may also be used successfully in holding doors shut on pieces of furniture such as book cases, sideboards, and dressers. In the illustration shown herewith a straight magnetic bar *A* is set in the casing of the door. A small square piece of iron *B* is fastened in the door. When the piece of iron in the door comes in contact with the magnet *A* the door is held shut; but it can easily be released with only a slight push. Any kind of knob or handle on the door will answer the purpose.



Magnetic door stop.

Making Life Figures of the Roosevelt Trophies

High Art in Modern Taxidermy

By Day Allen Willey

THE collection of African trophies secured by the Roosevelt expedition for the United States National Museum at Washington is now being mounted, or, to speak more correctly, sculptured. The work has progressed sufficiently far to enable one to form an idea of the realism with which the various animals and birds will be depicted in positions remarkably true to life. The collection when completed will form a notable example of the skill of the experts who are carrying out the various processes. When it is remembered that only hides, skulls, horns and hoofs form the natural bases for reproduction, the skill and labor required may be better realized. Fortunately the consignment reached Washington in good condition, owing to the careful skinning of the trophies and their preservation by packing them in salt.

The Roosevelt specimens reached the National Museum in casks numbering over 100, most of them considerably larger than a hogshead and weighing, on an avereage, 300 pounds each. The skins had been dressed and salted in the field by the members of the Roosevelt party, as stated. For the journey from Africa the hides were packed in brine, and, thanks to the careful packing, all of the skins arrived in Washington in good condition. The first step in the preparation of the specimens after their arrival at the museum wo:kshops was to send each hide to a tannery. This preparatory work was formerly performed by the museum experts, but it was found that economies of time and expense were possible if the hides were sent to the tanning establishment. The process employed is the standard one known to commercial practice, but special care was exercised, owing to the value of the specimens. When the hides were returned a special dressing by hand completed the preparation, and the specimens were ready for the actual mounting.

An interesting feature in connection with the reproduction is that these "animal artists" have no illustration, not even a drawing, before them, and work out the shape and proportions of the subject from original models based on their intimate knowledge of animal anatomy. They really conceive the shape and dimensions. The miniature model might be compared to an architect's tentative drawing or the preliminary sketch of a picture. It is designed to show the pose and position in which any of the given animals will be mounted, and it is especially valuable as a guide when many of the animals are to be mounted in groups designed to "tell a story" by representing graphically and faithfully some phase of jungle life. Such preliminary models are fashioned from "modeler's composite"—a very pliable clay-like material—and the taxidermist-sculptor may spend weeks of effort and change his model many times before he has every member of a group in the pose calculated to set off the animal to the best advantage.

After the miniature model has been completed and approved, the specimen receiving attention is modeled life size in white clay. Before he can undertake this task, however, the conscientious artisan must spend days or even weeks studying his subject. In the Roosevelt specimens, the workers have been especially fortunate, for the hunters made detailed measurements of all animals as they fell, before they were skinned. Apparently by inspiration the taxidermist proceeds to fashion a "make-believe" skeleton as a foundation for the life-size model he is to make. This counterfeit skeleton is formed from wood and wire and iron, with the skull of the original animal put in its proper place to insure the contour of the head. On this framework he builds out of clay an exact duplicate of the animal. From this clay model, plaster of Paris molds are taken, just as a sculptor takes molds of his clay model preparatory to having a statue cast in bronze. At the National Museum a dozen or more molds may make up a complete animal figure, the number of sections varying according to the size, form and pose of the animal. After the molds have been taken from the plaster model, the latter is destroyed, and now comes one of the crucial steps in the whole evolution, the casting of the permanent plaster figure upon which the skin is stretched.

Although the molds were made in sections, the figure of the animal is now cast as a whole. The cast is not a solid mass, but a shell. The plaster used is reinforced by means of burlap and wire cloth, and this reinforcement renders the hollow figure of the animal much stronger than such a shell would be under other circumstances—so strong, indeed, that a blow will merely result in a hole that can be easily repaired, instead of shattering the figure. When the cast is made, leg hooks or joints of metal—one for each of the four legs of the animal—are cast in plaster, and these enable the respective legs to be turned or removed at will. It enables the skin of the animal to be fitted intact over the legs of the figure, just as a glove is drawn onto a hand. In this way it is possible to put a skin in place on a plaster figure with only a single cut to be sewed to. This is located under the body, where it is not noticed. Under the old "flat-skin" figure there was an unsightly seam the full length of each leg.

After the plaster shell has been completed, it is given a coating of shellac in order that the skin may not come in direct contact with the plaster. Then the skin is drawn over the shell, first having been wetted in order to make it more pliable. Ordinary glue is employed to hold the skin on the plaster form, but the "working" of the skin into place is a most intricate process, since every wrinkle in the skin of the animal must assume its proper position. After the skin is in place, it is sewed by means of a ball stitch, with thread carefully selected to match the color of the fur or hair of the animal. Next the eyes are put in position. The eyes for the Roosevelt animals are being painted in oil on half globes of clear glass, the experts believing that by this method they will attain more accurate and lifelike results than could be derived with any of the "blown" eyes, as the manufactured product is known.

The Roosevelt collection at the National Museum contains specimens of many animals which are the most difficult to mount. Most baffling of all mammals from the taxidermist's standpoint is the hippopotamus. Next in order of difficulty are the elephant, the "rhino" and the giraffe. At present the taxidermists are busying themselves with such less exacting subjects as lions, tigers, leopards, zebras and a buffalo, which latter is a puzzling proposition, because there are no similar specimens in captivity, nor any photographs of the animal in the wild state to aid the artist.

The original processes employed in the work are the ideas of Mr. George B. Turner, the chief of this department of the museum.

Lionesses shot by Kermit Roosevelt.

Two of the finest specimens. A striped hyena and a leopard.

SOME EXAMPLES OF THE EXHIBIT AT THE NATIONAL MUSEUM

A German Use of the Sand-blast

THE cutting and wearing power of a stream of blown sand, long since utilized for various purposes, has been employed for testing building materials at the Gross-Lichterfelde Institute in Germany. Granite, pine wood, linoleum, and other substances used in the construction and furnishing of buildings are subjected for about two minutes to the action of a blast of fine quartz sand, under a pressure of two atmospheres. The results show the resisting powers of the substances tested to the effects of wear. This form of test is applicable to road-building materials.

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

Photography by Invisible Rays

IT is well known that on either side of the visible spectrum there is a field of radiations of which we cannot become directly cognizant by our sense of sight, although the physicist has found the means of procuring evidence of them. These are the rays of shorter wave length than the violet, the so-called ultra-violet rays, and others of longer wave length than the red, known as the infra-red rays. While the eye is not sensitive to the ultra-violet rays, the photographic plate is, and it is also possible to obtain a photographic record of infra-red radiation. In this day of scientific attainments we are becoming more and more independent of the limitations of our senses. If we want to obtain an idea of the appearance which the world would present to a person whose eyes were sensitive only to ultra-violet, or only to infra-red rays, we do not even have to rely upon our imagination, but, as Prof. Wood of Johns Hopkins University has shown, and explained in his Traill-Taylor Memorial Lecture, we can actually produce photographic views, concrete illustrations of the world "seen by invisible rays." To do this Prof. Wood interposes between the object to be photographed and the plate a suitable screen, which transmits only ultra-violet or infra-red rays, while absorbing all other radiation. Considerable difficulties are encountered in realizing this arrangement, especially in the case of ultra-violet rays. Ordinary glass is opaque to these rays, so that it becomes necessary to use quartz lenses. Then the problem arises of finding a substance opaque to ordinary light, but transparent to ultra-violet. There is only one substance known which completely satisfies this condition, namely, silver. If a thin film of metallic silver is deposited chemically upon the surface of a quartz lens, a certain amount of ultra-violet light is able to struggle through and form an image upon the plate.

As screens for the infra-red radiation Prof. Wood employs very dense cobalt glass. As this, however, transmits blue and some green, it is therefore necessary to combine with the cobalt glass a layer of potassium bichromate solution, which cuts off the undesirable rays.

Some of the effects obtained by Prof. Wood are very striking, as will be seen by reference to our illustrations, which are reproduced from the *Illustrated London News*. The first two of these show a landscape photographed in full sunlight by infra-red rays. The sky appears black, and the entire effect resembles somewhat that of a moonlight scene. A very peculiar feature is brought out in the third and fourth illustrations. The former is a view taken in the ordinary way by direct sunlight. The second is practically the same view, photographed by ultra-violet light. The remarkable thing about this is the absence of the man's shadow! After what has been said above, it is needless to point out that of course glass windows or mirrors appear nearly opaque on photographs taken with ultra-violet light. Another somewhat surprising fact is that Chinese white comes out black in such views. Quite apart from the interest which attaches to Prof. Wood's new method of photography considered merely as a curiosity, there is every probability that it will find a definite sphere of scientific and practical usefulness. An indication of this is given by a photograph of the moon in ultra-violet light, which brings out some features not otherwise observable. When we remember the very important work which has been done with the spectroheliograph within the visible spectrum, the opportunity which exists for research beyond these limits appears very enticing.

Photographed in full sunlight by the invisible infra-red rays. Prof. Wood's summer home at East Hampton, Long Island.

Like a snow-covered landscape in moonlight. Willows and other trees photographed in full sunlight by the invisible infra-red rays.

These photographs were taken in full sunlight; were given an exposure of about five minutes; and were developed like ordinary plates. Photographs by Prof. Robert Williams Wood.

By courtesy of *Illustrated London News*.

"The shadowless man."

A photograph taken under usual conditions and at the same time as No. 2 and showing the man's shadow.

A photograph taken by ultra-violet rays at the same time as No. 1, showing that the shadow is not present.

Air Sickness and Aviation Accidents

A FACTOR often overlooked is the illness or "sickness" which has been attendant on all efforts of the living organism to adapt itself too hastily to a different *milieu*. Thus we have sea-sickness, mountain-sickness, and car-sickness, besides that terrible disease known as the "bends," to which deep-sea divers and workers in caissons are subject, and which is due, not so much to the enormous pressure to which they have been subjected as to a too sudden lessening of the previous pressure.

All these may be termed maladies of maladjustment. To the list of these maladies a new one, that of air-sickness, has recently been added. The subject has been attracting much attention of late, particularly in France, and two physicians, Dr. René Cruchet and Dr. Moulinier, have just presented to the Académie des Sciences a highly interesting report of certain experiments and inquiries conducted by them.

Air-sickness does not seriously affect those who fly at moderate heights. It reserves it terrors for those daring aviators who seek to attain exceptionally high altitudes.

To some extent the mountain climber and the aviator seeking lofty altitudes work under similar conditions.

But in the case of the airman there are two specific factors of great significance.

In the first place, flight in a heavier-than-air machine necessitates a continuous, concentrated, physical and mental effort, and this under conditions which render the slightest relaxation of grave peril to life and limb, thus producing an exalted state of nervous tension. Then there is the extreme rapidity with which physical conditions are changed, and the corresponding inability of physiological conditions to adjust themselves in time to avoid violent disturbances. It is this factor which the physicians above quoted consider most significant in the production of the specific symptoms of air-sickness.

In general high flights have a duration of 45 minutes at most. An altitude of from 7,000 to 10,000 feet is reached in from 30 to 40 minutes, and the descent is of course even more rapid, occupying usually from 5 to 7 minutes. Biplanes are somewhat slower of ascent than monoplanes, but, on the other hand, they require more labor from the pilot.

Thus we have conditions in all altitude flights of rather rapid ascent and vertiginous descent, these conditions affecting the character of the biological action.

During ascent the respiration becomes quicker at about 5,000 feet, and the heart beats faster but usually without palpitation. Nausea and the sense of inflation of the stomach experienced by mountain climbers are usually absent, but there is a slight feeling of "malaise" or discomfort, which Morane attributed partly to the overpowering sense of intense solitude. The buzzing of the ears was not noted by Morane until nearly 6,000 feet of elevation, but novices observed it at about 1,200 feet, and even the former is considerably lower than the height at which mountain climbers are affected.

Morane states that the sight is always clear. "What makes it seem not so," he says, "is the great rapidity with which objects diminish and recede." He remarks, moreover, that when the day is fine but with a slight mist, the sun is reflected from the surface of the fog as in a mirror, so as to dazzle the aviator. This phenomenon is especially annoying where there are eddies of air, and may seriously interfere with steering the machine.

Even skilled aviators suffer from a slight headache encircling the temples at about 5,000 feet, while novices feel it sooner.

Cold becomes painful at about 7,000 feet. Above 5,000 feet, or even lower, the voluntary motions tend to become more nervous and jerky and the reflex motions have more amplitude. These motor modifications are easily explained by the combined effect of the cold, the quicker heart beat, the slight shortness of breath, the ear troubles, the reflection of the sun, and the nervous tension and fatigue.

In descent the heart beats more strongly, but the palpitations which are soon felt augment according to the precipitousness of the descent.

The rapid fall—over a thousand feet per minute—causes that peculiar feeling of emptiness experienced in a too swiftly descending elevator. There is a buzzing of the ears toward the end, and this may increase in intensity at the end of the flight.

But the phenomena which are dominant and augmented as the ground draws near are the redness of the face with a sensation of heat and pain, the smarting of the eyes, moisture of the nostrils, headache, and overwhelming fatigue, with actual drowsiness. This sleepiness is a very marked feature, and in itself indicates the enormous strain to which the aeroplanist has been subjected, and the resultant fatigue of nerve-centers. It is so great that the eyes close of themselves from moment to moment, in spite of the strongest desire to keep them open. In one case a searching party was sent out for a young aviator who had failed to return, and found him seated in his machine in the open country sound asleep! When waked he found it impossible to remember how he had arrived at the place where found.

On landing the motions are slow, lazy and awkward, in contrast to the native subject. Respiration tends to become normal very soon, but the headache

and sleepiness may last several hours, as does the disturbance of the circulation. The latter is marked by hyper-tension of the arteries, with cyanosis of the extremities, and blueness of the fingers. This augmentation of pressure in the arteries is confined to those who descend from great heights; it is somewhat less marked when there is excessive fatigue, but in this case palpitation of the heart and rapid pulse are noted. This condition might be dangerous when the subject had heavy brain-labor to do.

Obviously all altitude-seekers should have the condition of the heart and arteries often tested.

Our review of this subject would be incomplete without reference to the psychical factor. This, of course, varies with the individuality, but some of the most expert men have confessed to curious intellectual and emotional affections.

Morane spoke of a sort of "anguish," caused in part by the feeling of intense solitude. Another man, noted for his *sang-froid* and his virile energy, said that in the downward flight feelings of wretchedness and momentary fear assail one, and the thought of a dreadful death presents itself, and is the more terrible because of the semi-torpor of mind and body.

This mental and physical lethargy are spoken of by various aviators as preventing their performing as rapidly as is necessary the required mechanical acts, which upholds our argument that many accidents are probably due to the mental state superinduced by prolonged effort under unaccustomed conditions.

Renaux confessed that he was haunted by the thought of Chavez, achieving an immortal victory with a frightful death. Chavez's fatal accident, indeed, supports our contention. In crossing the Alps he rose very swiftly to a great altitude, from which he descended in a long, rapid glide. The quick checking of this glide by a sudden pull on the control wheel, is thought to have thrown such a strain on the wings that one of them broke off. It is highly probable that Chavez's mistake was due to the condition he was in, a condition resulting from the factors we have been considering, of the modified vaso-motor reaction, the hyper-tension of the arteries, headache, vertigo, and somnolence. There may even have been some mental confusion or hallucination. One aviator has, in fact, made the remarkable statement that he constantly had a vision of the spires of the cathedral of Notre Dame, as if they were close at hand, though he knew them to be hundreds of miles distant.

It is to be hoped that aspiring aviators will regard sensations of discomfort and illness not as a matter to be ignored or regarded with a hero's disdain, but as grave warnings from Nature that there are fixed limits to the adaptability, and especially to the possible speed of adjustment of the human mechanism, wonderful as that mechanism is.

Eliminating the Scratching Noise in Gramophone Reproduction

THOUGH much progress has been made in perfecting the phonograph of late years, in one respect it must be said that the instrument has remained hitherto somewhat disappointing. Inventors do not seem to have succeeded in hiding the nature of the process by which the sound is produced—the scratching of a hard record by pointed styli. Superimposed upon the sounds which are intentionally produced, is the scratching noise of the tracing point. Add to this the unwelcome accentuation of certain harmonies out of proportion to the natural intensity, the net result lacks somewhat in artistic value. Whether these drawbacks can ever be completely overcome in an instrument based upon a comparatively crude material mechanism, or whether the final solution is rather to be looked for in an instrument of the Poulsen type, for example, may here be left undiscussed. That the common form of phonograph is still capable of improvement will at any rate hardly be denied. Some very promising results seem to have been obtained by John G. McKendrick, who reports on them in *Nature*. The author says:

"I have made many efforts to get rid of the hissing and grating noises that detract so much from the instrument as a reproducer of musical sounds, and at last I have had an encouraging measure of success. The gramophone is inclosed in a wooden cloth-lined box, and a tube passes tightly through a hole in the wall of the box from the end of the taper arm that carries the sound box of the instrument. When the sound box is tightly closed by raising and locking the front lid, the sounds of the machinery, and also the vibrations from the free side of the diaphragm of the sound box, are completely damped off. The noises, caused by the friction of the needle point on the hard disk of the record, pass, of course, along with the musical sounds, through the taper arm to the tube that escapes from the box. This tube is suitably connected with lengths of tin tubing, 1½ inches in diameter, and the sounds are thus conveyed through as many feet of tubing as may be found necessary. I have found the most efficient length of the entire tube, until it reaches the horn or resonator, to be, say, 54 feet.* The effect of the long tube, while empty, is to increase the volume of the tones, but, of course, the noises are also intensified.

"I have always been struck by the fact that the friction noises seem to be quite separate and distinct from the musical tones, either when a voice is singing with an accompaniment, or during the reproduction of an orchestral piece of music—indeed, by an effort of attention, I have so trained myself that I can hear one without hearing the other. This suggests that in the ear there is a mechanism for the detection of noises of high pitch as distinct from ordinary musical tones. It occurred to me that by causing the sounds to pass through numerous narrow channels, freely communicating with each other, the noise-sounds, presumably caused by short waves of high pitch, might be damped off by interference, while the longer waves, corresponding to musical tones, might pass through unaltered, except as regards loss of energy from friction. My purpose was attained by filling a segment of the tin tube, say, from 4 to 8 feet in length, with a mixture of hard peas and beans, corrugated by age or drying. The experiment succeeded. The friction noises were damped down, while the musical tones, although rather 'dulled' in quality, that is to say they lacked brilliancy, were purer, and, to my ear, much more natural.

"Other substances were tried—glass balls, marbles, small fir cones, gravel, shreds of tin—but the best effect was obtained with the peas. Brilliancy was obtained by using, as suggested by Mr. Ernest de la Rue (who has been much interested in these researches), zinc tubes filled with fragments of corrugated zinc, and the use of these has been protected by patent by Mr. de la Rue. By a combination of the zinc fragments with the peas and beans, I get delightful effects, so that the gramophone music is so immensely improved that I cannot listen with any pleasure to the 'naked' gramophone sounds, as the attention is not now disturbed by the 'frying-pan' noises.

"As listening to music so reproduced is a kind of auditory illusion, any contrivance that will heighten the illusion may be expected to give more pleasure if the illusion is of the right kind. Usually one feels a sense of unreality in the music apparently rising from the bottom of the 'horn,' more especially in listening to a human voice. To get rid of this, I angle the horn so as to reflect the sound waves from a tin reflector (parabolic in character) so placed as to send the sounds to the other side of the room. One then ceases, while listening, to think of either the gramophone or the horn, as the sounds come from the reflector, and the effect is much more real and natural.

"I believe the application of this method of 'acoustical filtration' may be applied by ingenious mechanics in such a way as to do away with the necessity of using such an extended length of tube. The method enables one, in a room of moderate size, to listen to pure music. One cannot help observing how it mellows a voice that, heard in the ordinary way, sounds harsh (from the production of overtones of high pitch), and how it brings out the pure tones of the string instruments. The various instruments in an orchestra sound better. Everything is reduced in proportion, and to use an illustration from art, it is like passing from one of Etty's huge pictures to a delicate and beautiful Meissonier, in which one sees and appreciates every detail in an area of small dimensions."

* This length of pipe is, of course, doubled up in a number of zigzag bends.

An Electrically-heated Steam Boiler

A STEAM generator is made by a New York firm for use on trains running over sections of line in which electric locomotives are used. The generator consists of a cylindrical boiler arranged with its axis vertical and having tubes extending between tube plates at the top and bottom. Into each tube, which is closed at the bottom by a screw plug, there is slipped an electric heating element. This comprises a number of steatite tubes threaded on a metal rod with special stellate porcelain insulators of larger diameter between them. These porcelain insulators fit into a thin brass tube and serve to keep the resistance wire, which is wound on the steatite tubes, out of contact with the brass tube. Fine siliceous sand is used to fill up the space between the resistance wire and the interior of the brass tube. All the elements are connected in parallel to bus-bars through fuses which blow when the current rises to 60 per cent above normal. A boiler 3 feet 10 inches in diameter and 4 feet 6 inches long (between tube plates), with 148 2-inch diameter tubes, has a maximum evaporating capacity of 850 pounds of steam per hour at 110 pounds per square inch, with current at 666 volts. It gave an efficiency of 91.9 per cent at 653 volts and 470 amperes in a New York Central locomotive.

Port of Brussels

A PIECE of engineering work is now being carried out at a cost of $10,000,000 in order to connect Brussels with the sea by a maritime canal and thus make Brussels a seaport. The enlargement and transformation of the old Willebroek canal commenced about ten years ago as a result of a long campaign in the press and numerous meetings in which it was pointed out that such a large center with 750,000 inhabitants should no longer be under its present disadvantage and that it should give entrance to sea-going vessels so as to become one of the important European shipping centers. The old canal was laid out in the sixteenth century on the plans of Burgomaster Jean de Locquenghien, and it ended on the seacoast near the mouth of the Escaut. It belonged to the city of Brussels, but when it came to transforming it a large financial enterprise was formed, including the State, the city and the neighboring communes. The work comprised the enlargement of the old canal so as to give a maritime canal, the construction of a suitable port at Brussels with its basins, docks and storehouses, and the company is afterward to keep on operating the canal. A draught of 19 feet 6 inches is allowed for vessels, and the width of the canal at the water line is 130 to 200 feet, and at the bottom at least 80 feet for the standard sections. For the enlarged points used as a by-pass for vessels the canal width is 230 to 330 feet. Between Brussels and Antwerp there are three maritime locks of 52 feet width, 380 feet length and 22 feet depth, together with smaller sized locks of 220 feet length and 28 feet width. The new port at Brussels will comprise a maritime basin and a fore-port, the first measuring 2,700 feet length and 400 feet width, while the available length of the quays will be no less than 5,600 feet. Railroad trains will be brought alongside the basins in a special depot of large extent, covering over 60 acres, and this will suffice for a daily traffic of 800 cars. The fore-port will be 360 feet width and will have 6,300 feet of quays for the landing of large vessels. All this great work is now nearing completion, and it is expected that it will be finished during the present year.

The Application of the Gyroscope and Compressed Air to Taking Moving Pictures

IN a paper published in the *Comptes Rendus*, M. G. de Proszynski remarks that the scope of the kinematograph for non-artificial views—in other words, its scientific utility—is at present very limited, owing to the necessity for posing the instrument on a very steady base. The tremblings which injure definition if the instrument is not sufficiently steady fall under four headings: (1) Movements of translation. (2) Oscillations around the optic axis. (3 and 4) Oscillations around axes perpendicular to the optic axis. The effect of 1 and 2 is negligible. To obtain a sharp impression it is sufficient to annul or reduce oscillations 3 and 4. This Proszynski does by employing a gyroscope with its axis parallel to the optic axis of the apparatus. The requisite dimensions and velocity of the gyroscope may be calculated from consideration of the admissible maximum displacement of the impression on the plate in a given time, and of the forces due to shaking of the hand and weight of the apparatus. The gyroscope, however, only annuls short, rapid movements, and does little to counteract slow movements, such, for example, as are imparted to the apparatus by turning the handle. To avoid this inconvenience de Proszynski has constructed an automatic apparatus comprising a pneumatic motor, which is at once light, powerful, and very small. The air reservoir can be recharged by means of a small hand pump.

Light and Sound Waves

WITH reference to our ability to tell the direction from which sound proceeds, attention may be called to an interesting difference between the eyes and the ears in relation to the size of the waves that strike them.

The average wave length of light is about one ten-thousandth of the diameter of the pupil of the eye. On the other hand, according to Rayleigh, the waves of sound proceeding from a man's mouth are about eight feet long, whereas the diameter of the passage of the ear is quite small, and could not well have been made a large multiple of eight feet. One consequence of the minuteness of light waves in comparison with the size of the eyes is that the lenses of the eyes are able to concentrate rays of light upon the retina with great efficiency.

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

Principal Examiner Giles S. Rafter

GILES S. RAFTER is a native of New York State, but prior to his entry into the Patent Office in 1882 was a lawyer in Kansas. On entering the Patent Office he was for a while in the division of Prof. B. S. Hedrick, and took his degrees in the law in the National University in Washington, and after a

Principal Examiner Giles S. Rafter.

short service in Prof. Hedrick's division was transferred to the division of paper manufacturers and printing, where most of his experience as an assistant examiner was gained. He was still an assistant in this division in 1904, when promoted to be principal examiner.

In the division of paper manufacturers his attention was devoted principally to the complicated class of inventions relating to typesetting, justifying and distributing machines, and linotype machines. While examining this class, he had charge of probably one of the most complicated applications ever presented to the Patent Office. This was the application relating to the Paige typesetting, justifying and distributing machines. The machine itself was one of the most complicated ever invented, and the patent eventually granted is the most voluminous ever issued. Ordinarily machines are adapted to perform an operation, or cycle of operations, and continue to do so indefinitely; the Paige machine, however, has its operation determined by the condition of each line of type with respect to the length, number of word spaces, etc., taking note of such conditions with machine sense, and then proceeding automatically in its operation in accordance with the requirements of that line. Two applications were filed to cover the machine, one relating to the general organization and having 204 sheets of drawings, but eventually limited to 163 sheets; and the other with Mr. C. R. North, as joint inventor, relating to the justifying features, and having 81 sheets of drawings. It was desired by the applicants and the examiner that the examiner be permitted to go at the expense of the applicant to a distant city and examine the application in connection with so much of the machine as had been constructed, and the working drawings. When the Commissioner's consent to this arrangement was sought, he refused to agree, on the ground that it was against the policy of the office, and if it was done in one case, might be done in another. The examiner urged that this was an extraordinary case, and in supporting his position asked the Commissioner to permit him to bring the applications down in order that their magnitude might be appreciated. It is said that several messengers were required to carry the applications into the Commissioner's office, and the exhibits in the case were so formidable that he could not further refuse to permit the assistant examiner to make the trip.

The machine was a result of nearly twenty years of constant work by an able engineer and inventor, and the original machine is now said to be in the possession of Cornell University. The patent is one of the curios of the Patent Office, and it was fortunate for the Patent Office that so robust a man both mentally and physically as Examiner Rafter had the matter in charge. Many men would have succumbed under the tremendous strain incident to the examination of so complicated a machine.

Mr. Rafter at present has charge of Division 2, including such important classes as presses, tobacco, label affixing machines and pneumatics. He has a temperament eminently fitted for the examining duties, which, reinforced with a strong physique, great application and a fine capacity for work, makes him a very useful examiner.

Principal Examiner Benjamin W. Pond.

IT has often been a matter of conjecture why so many patentees and patent attorneys preserve their mental vigor and alertness through long periods of great activity. Of such preservative effect the subject of this sketch is a splendid example. He was a principal examiner in the Patent Office when most attorneys and examiners of this time were school boys, and he has pursued a calm, even way through the years, with the cordial respect of all and the warm regard of those intimately associated with him.

Mr. Benjamin W. Pond was born in Bangor, Me., son of the Rev. Enoch Pond, president of Bangor Theological Seminary, and passing through the public schools of his native city, entered Bowdoin College, from which he graduated with the class of 1857. Following in his father's footsteps, he was bred to the church, and occupied the pulpits of Congregational churches in several places until the spring of 1873, when failing health required him to seek a milder climate than that of his native New England.

In the summer of 1873, upon the results of competitive examination, he was appointed a third assistant examiner in the United States Patent Office, and was promoted rapidly until, in August, 1877, he was appointed principal examiner, and assigned to Division 4, which has ever since been in his charge; a period now of nearly thirty-four years. Examiner Pond's Division 4 includes the important classes of bridges, conveyors, cranes and derricks, hoisting, excavating, hydraulic engineering, loading and unloading, and metallic building structures, covering a very active field in civil engineering.

Mr. Pond is not only a gifted theoretical engineer and mechanic, but is an accomplished practical mechanic, and is recognized as a particularly clever carver of wood.

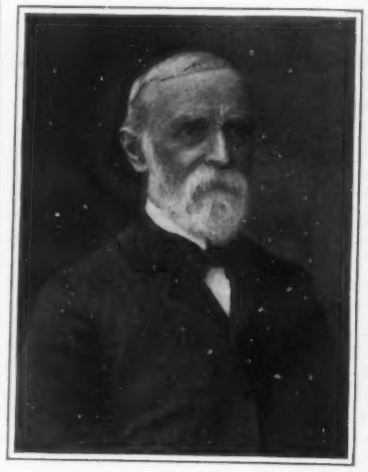
A New Method of Metal Coating

By Our Paris Correspondent

A SWISS engineer, M. Schoop, has invented a new process for producing a metal coating on various materials, by spraying a cloud of finely atomized metal particles upon the surface to be covered. The new method was first demonstrated before the Engineers' and Architects' Association of Zurich, and has since been presented also before the French Academy of Sciences by Prof. D'Arsonval.

The metal is melted in a crucible *d* and is allowed to escape by a capillary opening *g*, under a pressure placed upon the surface of the melted metal by compressed air or other gas. Just after emerging from the opening, the thread of melted metal escaping under pressure is atomized by a gas or steam spray, so as to form a cloud of finely-divided metallic particles. Through this cloud is passed very rapidly the object which is to take the coating. An inert gas is best used to give the pressure on the melted metal, while another kind of gas can be used for the atomizing. If desired, such a gas may be used at this stage as will oxidize the metal, so as to give a coating of oxide instead of metal. The action of depositing the metal appears to be as follows:

When the metal is atomized in the form of a cloud, its particles strike the surface which is to be covered, but here they lose their original spherical form and are flattened out upon the surface into blotches which unite together and form a continuous layer of a certain thickness over the object. The metal is projected at a very great speed from the orifice, and this explains why the particles which are no longer liquid when they reach the surface of the object, are able to make up a homogeneous and very compact layer whose density is about the same as for the metal in its usual state, as experiments made at the Zurich laboratory have shown. Even though the metal has been melted in the crucible, the vapor is not very hot when it is projected out by this process, so that there is no difficulty in depositing it upon readily combustible substances, such as paper, wood, celluloid, or even animal tissues. The deposits of metal thus prepared are much harder than those ob-

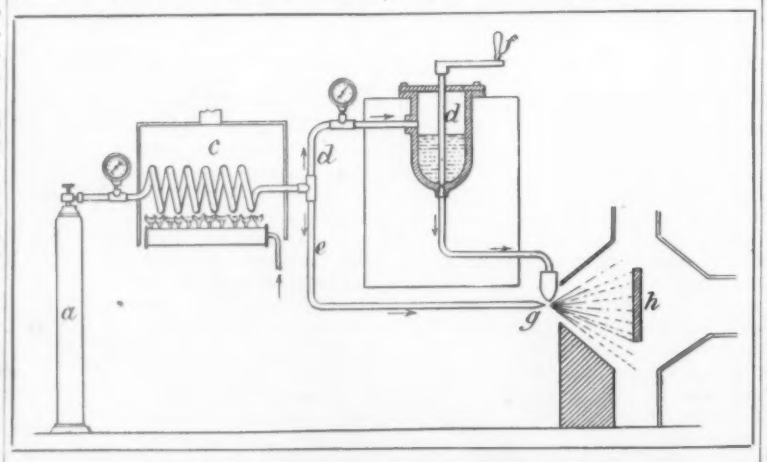


Principal Examiner Benjamin W. Pond.

tained by the usual methods. For instance, tin, when cast, showed only a little over one-half the hardness of tin applied by the Schoop process, when tested by the Brinell method of dropping a steel ball and observing the mark made by it. Under the microscope there appeared to be no difference as to the fineness of the structure as compared with the ordinary metal.

The new process lends itself to a number of interesting and useful applications, since most of the common metals can be deposited in layers upon various surfaces. One very important use should be the coating of structural iron to protect it against weathering. The operation should be readily applicable to finished structures, such as cranes, bridges, etc. There should be no difficulty in making the coating apparatus portable, so that it can be used on the spot to coat the ironwork all over with a non-rusting metal layer more durable than any kind of paint, and, as the inventor claims, also more economical. Numerous applications which suggest themselves for the new process might be divided into two classes. On the one hand we may wish to coat an article for decorative or protective purposes; on the other hand the aim may be to form a crust over an article, in order to subsequently strip it off in form of a mold. Additional uses of a somewhat different character are the coating of wood, porcelain or glass, to render their surfaces conductors of electricity; and the metal coating of glass mirrors, whether parabolic, spherical, plane, or of any other kind.

Among the uses which may be made of the process for the purpose of applying a protective coating, may be mentioned the encasing of telegraph poles at the end which is buried in the earth, and especially at the point where they emerge from the ground. By metal-coating wooden propellers for airships and aeroplanes the double purpose may be served of imparting to them a protective coating and reducing their friction. A peculiar application is the deposition of an aluminium layer one-eight-hundredth of an inch thick upon balloon envelopes, whereby they are rendered gas and water tight. Capsules for bottles can be very



Atomizer for use in the new process of metal coating.

a. Cylinder containing compressed gas. *c*. Furnace for heating the gas. *d*. Crucible for melting the metal. *g*. Atomizer nozzle. *h*. Article to be coated.

economically replaced by metal coating put on by the new method. A bottle thus sealed is hermetically closed, and cannot be used again without showing obvious signs of having been opened before. A good substitute for tinfoil, such as used for wrapping chocolate and the like, can be made by metallizing paper, the surface of which is burnished or in any other way given a bright or satinized surface. The somewhat perplexing problem of coating metal or other substances with aluminium seems to be most satisfactorily solved by Mr. Schoop's new method. This application alone would render the new process very valuable. Other uses which have been suggested are the metallizing of textile fabrics, of the inner surfaces of new pneumatic tires, the coating of bottles and other vessels for use in chemical industries, the metallizing of carpets for theater decorations, and numberless others which will readily occur to the reader.

Examples of the second class of application mentioned above, in which the process is used to produce a surface mold, are the manufacture of printing blocks, stereotype and matrices, and the production of a variety of articles ordinarily prepared by the galvano-plastic process. There is no difficulty in making hollow objects, such as, for instance, seamless metal tubes. The possible applications of the new process seem, in fact, almost unlimited, while the inventor claims that in point of view of economy his process easily wins over most of the methods at present in use.

The Work of the Washington Conference

THE conference of Washington of the International Union for the Protection of Industrial Property came to an end on June 2nd, when an agreement was signed, which will be amendatory to the Paris Treaty of 1883. Of course the nature of the agreement will remain secret until it is ratified by the respective governments.

The sessions of the conference have been extremely interesting, and the conference of Washington will be honored, it is stated, by the addition of several non-union nations to the ranks of the union or adhering nations.

The weather at Washington was extremely hot throughout the conference and served to bring the deliberations to a speedier close. The thermometer stood in the neighborhood of 100 degrees during the opening days, and many of the delegates worked with their coats off, which established an absolute precedent so far as international conferences are concerned. It was indeed an unusual sight to see the distinguished diplomats arrayed in their shirt sleeves, collarless and in many cases vestless, guiding the destinies of international patent and trade mark laws.

The foreign delegates were the guests of the United States on an excursion to Atlantic City on the 20th of May. A special train was run over the Pennsylvania Railroad, and accommodations were arranged at the Hotel Marlborough-Blenheim. When the party discovered a difference in temperature of about 40 degrees between Washington and the New Jersey resort, it was with difficulty that they could be induced to return to the capital. The majority were in favor of continuing the deliberations at Atlantic City, where the accommodations and the atmosphere combined to make things thoroughly delightful.

A pilgrimage was made to Mount Vernon, the tomb of Washington, where a memorial wreath was presented by the foreign delegates, and a speech was made by M. Georges de Ro, the vice-president of the conference, and one of the delegates for Belgium.

The crux of the formal entertaining was reached on the 27th, when the foreign delegates were the guests of Ambassador Tower, president of the conference, and the five United States delegates, at a banquet, at which nearly two hundred guests sat down. The banquet was held in the large hall of the Hotel New Willard, which has been the official headquarters of the conference. Ambassador Tower presided at the banquet, and made an address of welcome which was very happy in its vein, and in which he complimented the conference on the rapidity and thoroughness with which its labors had been conducted. The Ambassador of France, M. Jusserand, addressed the guests in French, and laid a great stress upon the world-famed hospitality of America, and congratulated the delegates upon their good fortune in being able to see Washington and the United States under such favorable circumstances, as the guests of the nation. M. Jusserand closed his remarks with an address in English. Not to be outdone, the British Ambassador, Mr. Bryce, spoke in English and wound up with a complimentary address in French. He was followed by the Mexican Ambassador, who spoke of the great sympathy that the nations of the earth and particularly the United States of America had extended to his countrymen in the time of their national sorrow and peril, and was warmly applauded. The Minister of Portugal, Vicomte de Alte, spoke on behalf of the delegate diplomats to the conference, and M. De Ro, on behalf of the delegates in ordinary. The Secretary of the Interior, Mr. Fisher, made a speech full of humor and good sense, which was much enjoyed. Among the guests were the Turkish Ambassador, most of the ministers and envoys accredited to Washington who were in the capital, and a distinguished list of *chargés d'affaires* and secretaries of embassies and legations. The Secretary of State was unable to be present on account of illness, and the President had already sent his regrets, on account of an engagement of long standing.

The President received the delegates at the White House during the second week of the conference, and each had the opportunity for a word with him. He manifested a deep interest in the subject of the revision and unification of international laws relating to industrial property. Many of the delegates were presented to the President in person by their ministers and ambassadors. Mrs. Taft entertained the conference at a garden party on the White House lawn, a function that caused particular delight among the foreigners, all of whom have shown a most gratifying interest and pleasure in the attentions paid them in this country.

M. Capitaine of the Belgian delegation has planned a trans-continental trip at the close of the conference, and he will visit Yellowstone National Park, Yosemite National Park, the Grand Canyon of the Colorado, the Canadian Rockies, and all the cities of the Pacific coast. M. Capitaine is the leading patent attorney of the very important manufacturing city of Liege, and will during his trip make a study of trade conditions. He is an expert upon the subject of the international protection of industrial property.

Col. Herbert Hughes, the law clerk of the Sheffield Cutlers Company, who accompanied the delegation of Great Britain as expert adviser, is a student of battlefields, and has embraced every opportunity to visit the famous battlefields in the vicinity of Washington and Richmond. As Maryland and Virginia are rich in traditions of this sort, Col. Hughes, in addition to his official duties, has been a very busy man.

A Prize for a Safety Lamp

IT is announced in the daily press that Mr. Winston Churchill, Home Secretary of Great Britain, has offered, on behalf of an anonymous colliery owner, a prize of $5,000 for an efficient electric safety lamp. The prize is open to the world.

Notes for Inventors

A Rapid Manual Brake Wanted for Trolley Cars.—In talking with an official of long experience in electric traction lines, both city and suburban, the writer asked him what is the most needed improvement in traction systems in a mechanical way. His reply was surprising, but the promptness with which it was made rendered it the more convincing. He said what is most needed right now is a rapid action manual brake. In other words, a manually operated brake that can be quickly applied, something between the slow chain winding brake and the quick air brake. Of course, the brake should be strong, be capable of application without too much effort by the motorman, and should be capable of ready and economical application.

The New Congressional Committee on Patents, Trademarks and Copyrights.—The old patent committee of the House of Representatives lost only four members out of its fourteen in the recent political shake-up, but probably many of the members of the old committee will not be on the new Committee on Patents of the House of Representatives.

Mr. William A. Oldfield of Arkansas is the new chairman of the Patent Committee, and the Democratic members thereof have been named as follows: M. A. Morrison of Indiana, E. Y. Webb of North Carolina, Frank Clark of Florida, Joshua W. Alexander of Missouri, R. J. Bulkley of Ohio, M. W. Littleton of New York, Oscar Callaway of Texas, S. A. Witherspoon of Mississippi.

The geographic distribution of the Democratic members is somewhat peculiar, as the North and East have but small representation among the members. Mr. Oldfield, the chairman, is enthusiastic upon the subject, and like most of the members is a trained lawyer.

Don'ts for Air Brake Inventors.—An inventor is always interested in what to do, what to invent, what is needed, and similar propositions, and should therefore attend the negative side suggested in what not to do, or "Don'ts." The last annual report of the Block Signal and Train Control Board to the Interstate Commerce Commission contains some advice under the head, "Don'ts for Air Brake Inventors." Some of these which are quoted below are not confined to air brake inventors, but have a general application to all fields of inventive activity. Notice the following:

"Don't be satisfied with yourself or your first or even last idea of a device. Look for the defects, not the merits in any design you propose to patent. The latter will always take care of themselves. An apparent success, however, is oftentimes more fatal than flat failure. The latter at least tells the truth, and usually teaches a valuable lesson; the former raises false hopes and obscures the truth, and results in a corresponding greater failure when the final reckoning does come."

Also this very brief, but important piece of advice:

"Don't attempt to find a remedy for a known defect by getting around its effect, but first discover the cause and overcome that."

As to the human equation in its relation to "fool-proofness," the following is worthy of thought:

"Don't overlook the fact that simplicity, interchangeability, fool-proofness, and low first and maintenance cost, often have more to do with the success of a device than ingenuity of design or nicety of construction."

Some Interesting Recent Patents.—Among some interesting patents recently issued, we refer to one numbered 989,714, for a watchmaker's appliance, including a stethoscope which is applied in operative relation with a watch movement; patents 989,722 and 989,723, to Richard H. Rice, for turbines; patents 989,802, 989,803 and 989,804, to William D. Rennie, for process of electrolytically extracting metals and for compositions for use in the process; patent 989,927, to George M. Saybolt, for a process of obtaining naptha from natural gas; patent 990,121, to Franklin J. Drake, U. S. N., for method and apparatus for lifting fogs, including the projection upwardly through the fog at suitable intervals of columns of gases under pressure, producing currents to dissipate the fog; and patent 990,183, to Charles G. Ashley, for a relay in the form of an instrument for increasing the amplitude of wave form current, including windings as defined in the said patent.

A Design Patent for an Animal Trough.—A recent design patent for an animal trough, presumably a hog trough, arouses curiosity as to how far the ornamental features of the trough will affect the gastronomical ambitions of the animal, and recalls the old story of the scientific stranger who rebuked the farmer for feeding his hogs hard corn instead of soaking it over night. The former asked why that was better, and the stranger said the hogs could digest the soaked corn in one-half the time they could the unsoaked, whereupon the farmer said, "Stranger, what do you calculate a hog's time is worth around here, anyhow?"

Relieving Automobile Tires of Weight.—The writer's neighbor has a new automobile, high powered and heavy, resting with much weight on its tires. His proposition is to jack up the machine off the tires over night to relieve the tires of the pressure when the machine is not in use. It is troublesome to place and operate four jacks independently. With the power right at hand in the engine of the machine, it seems that someone should be able to devise a convenient, readily-operated lifting device which could be actuated by the power of the machine to lift the four corners of the machine simultaneously and thus relieve the wheels of the weight.

A New Lightning Arrester.—A patent, No. 991,483, has been granted to E. E. F. Creighton, assignor to General Electric Company, for a protective device including a lightning arrester which has electrodes separated by a spark gap of constant length, and which develops in a direction opposite to the movement of the vapor liberated from the electrodes a gas blast whose velocity is greater than the velocity with which the vapor moves across the gap so that the vapor is carried away from the gap and thereby the formation of an arc is prevented when a disruptive discharge takes place between the electrodes.

Another Air Brake Patent.—A patent, No. 991,538, has been granted to Walter Phillips of London, England, assignor to the Westinghouse Air Brake Company, for a fluid pressure brake in which an electro-magnetic device controls the brake cylinder pressure and an electric generator which is driven by the momentum of the vehicle for varying the supply of current to the electro-magnetic device according to the speed of the vehicle, is thrown into action when the brakes are applied.

A Woman's Invention.—A patent, No. 991,496, has been granted to a Kansas woman for a guard for the wheel and bobbin winding mechanism of a sewing machine, which guard has two upright members, one extending alongside the flywheel and around the rear edge of same and the other extending around the front edge of the flywheel, the members being connected together and means being provided for securing them to the base of the machine.

A Cosmetic Booklet.—A patent (No. 990,270) has been issued to a London lady for a cosmetic booklet which has a number of leaves saturated with a rouge composition and interposed waxed leaves which are perfumed to transmit their scent to the saturated leaves, perforations being formed so that the leaves may be conveniently torn off as in the ordinary postage stamp books.

Legal Notes

The New Federal Judicial Code.—By John A. Mallory.—In the excitement of the struggles in the closing days of the Sixty-first Congress over measures of more general interest, the "Judicial Code" passed into law almost unnoticed. The changes made by it in the judicial system are important, and, although they do not take effect until January 1st, 1912, some general mention of them may well be made now.

The code, as framed by the Commission to Revise the Laws, was a revision of the whole of the title "Judiciary" of the former Revised Statutes; but, as enacted, it contains only provisions relating to the organization and jurisdiction of the courts. All that relates to procedure and evidence, to officers not directly attached to the courts, to fees, etc., is left for other parts of the general revision, mostly, it may be presumed, to be included in a Code of Procedure.

The one great change made is the entire abolition of the Circuit Courts. The appellate jurisdiction of those courts having been taken away by the act of 1891 which created the Circuit Courts of Appeals, the original jurisdiction still left to them, and all their powers and duties, are now conferred on the District Courts. Thereby all the federal jurisdiction of courts of first instance is consolidated in the District Courts. The appellate jurisdiction of Circuit Courts of appeals and of the Supreme Court remains unchanged. The system of courts of general jurisdiction will be, therefore, one court of original jurisdiction, one intermediate court of appeal, final in many cases, and one Supreme Court, of final jurisdiction. This general plan was originally designed for the federal judicial system, and has been adopted in many of the states.

The provisions relating to the three courts of special jurisdiction—the Court of Claims, the Court of Customs Appeals, and the Court of Commerce—are included in the code in separate chapters.

The commingling of original jurisdiction in the Circuit and District courts at present, which gives to both concurrent jurisdiction of most cases, but to each exclusive jurisdiction, respectively, of certain other cases, has long been a cause of perplexity and confusion. The removal of this difficulty and unification of all procedure in the first instance in a single tribunal will be welcome to litigants and to lawyers.

To the general public, and to the Government, in the administration of justice, the simplification of organization will be very beneficial. We have now 77 judicial districts, in most of which divisions have been created, or two or more places designated for holding courts, so that courts are required to be held in some 276 different places. In each district and division there is necessarily maintained the complete organizations of both a Circuit Court and a District Court, with all the officers and equipments requisite for holding court in all the places designated. This expensive duplication of judicial machinery will cease, and the conduct of judicial business in a district by a single court should be more efficient and consistent, as well as more economical.

This change might well have been made in 1891, as was proposed, when the appellate jurisdiction of the Circuit Courts was transferred to the Circuit Courts of Appeals, then created. As the Circuit judges have been almost wholly occupied in the latter courts, the work in the Circuit Courts has devolved more and more on the District judges, who now, sitting alone, usually hold both Circuit and District Court, at terms appointed for the same time, at the same place. The superfluity of the separate organization has become very apparent.

Another excellent feature of the new code is the revision of the laws relating to the judicial districts themselves. Since the districts as existing in 1873 were defined in the former Revised Statutes, acts of Congress creating new districts and divisions of districts have accumulated, forming a very complicated series of provisions. These have been very carefully revised, and inconsistencies and discrepancies removed, and the seventy-seven districts and their divisions, as now existing, have been described, and the territory included in each, where necessary, defined anew.

The acts thus creating new divisions or designating new places for holding courts usually provide where suits of a local nature shall be brought, where process shall be served, where prosecutions for crime shall be instituted, when and how cases may be removed from one division to another, how pending cases are to be disposed of after the division is established, when and from what places juries are to be drawn, and for various other matters of local procedure. These provisions, of merely local application, and varying in detail, though for similar purposes, have all been eliminated, and their place supplied by general provisions covering all such subjects, and applicable to future changes.

The new code is based on the Report of the Commissioners to Revise the Laws, of the title "Judiciary," to the extent of the portions of that title covered by the code. That title was reported by the Commissioners originally in 1901, and finally in 1909. Comparison with the code as enacted demonstrates that the Joint Committee of Congress on the Revision of the Laws, besides incorporating recent legislation, must have expended much care and labor on the details of the code, in adjusting its provisions to one another and to existing and future conditions. The result is a great improvement in the form of the laws on the very important matters covered.—*West Publishing Company's Docket.*

Employer and Employee.—In the case of Ladoff v. Dempster, Dempster v. Ladoff, decided by the Court of Appeals of the District of Columbia March 6th, 1911, the Court, by its Chief Justice, said:

"The principle is well settled that if one employed to carry out an invention by another of a machine, manufacture, or composition of matter, makes valuable discoveries ancillary to the plan and preconceived design of the employer, such discoveries inure to the benefit of the employer. And the principle applies to the case of principal and assistant engaged in the work of a common employer, as these parties were. (Braunstein v. Holmes, 30 App. D. C., 328-331; Robinson v. McCormick, 29 App. D. C., 98-108.) But as said in the last case cited:

"'To claim the benefit of the employee's skill and achievement, it is not sufficient that the employer had in mind a desired result, and employed one to devise means for its accomplishment. He must show that he had an idea of the means to accomplish the particular result, which he communicated to the employee in such detail as to enable the latter to embody the same in some practical form.'"

The *Patent Office Official Gazette* briefs the case in its syllabus, as follows:

"D was employed to improve upon the magnetite electrode of S. He made several different combinations of material, one of which contained 3 to 12 per centum of titanium oxid. L was employed to assist D, and mixed, fired and tested the pencils according to his directions, but was not called upon to advise or assist him in any other way. While doing the work L conceived the idea of an entire or substantially entire reduction of the oxids to iron. *Held*, that this did not inure to the benefit of D, since it was not a mere mechanical improvement of the thing L was employed to perfect."

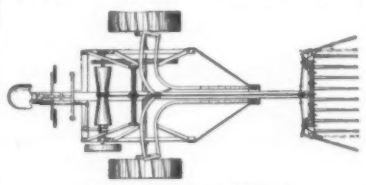
RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of Interest to Farmers.

PLOWING MACHINE.—D. F. KUSTER and G. J. NIEMANN, Washtucna, Wash. In operation the machine is drawn down through the field, and the pressure of the soil against the disks of the swinging frame holds the said frame in inclined position with respect to the tongue, since the greater portion of the pressure is on the inner end of the frame. The disks are then in best possible position for pulverizing the soil, and are held automatically in this position, but may yield to avoid obstruction.

AUTOMATIC SHOCK LOADER.—ALFRED HILLSTROM, 11142 Michigan Avenue, Chicago, Ill. The invention shown in the engraving has in view a machine adapted to load the shocks while continuously traveling and embodying a fork pole fulcrumed at the



AUTOMATIC SHOCK LOADER.

front of the truck to swing both vertically and laterally, and directed in its movements by a downwardly and outwardly-inclined guide having guide arms at the top extending to the opposite sides of the truck, a switch being arranged at the fork of the guide to direct the pole into either of the arms.

Of General Interest.

OIL TANK CONSTRUCTION.—J. G. HITCHFIELD, Berkeley, Cal. The invention provides a structure for oil containing tanks of portable and other character that hold oil so as to prevent leakage; provides a structure of tank compartments for ships to transport oil; provides a backing for oil containing compartments when formed in ships to render the structure solid and to prevent puncture of the lining material; and provides a lining for the compartments that allows for vibration and working of the ship, and reduces the danger of fire.

JOINT FASTENER.—D. A. WRIGHT, San Antonio, Texas. This fastener is adapted for screens and is provided with arms, with cut portions forming laterally projecting teeth so that when the arms are pushed inwardly in kerfs in a member of the frame of the screen, the teeth will be pressed in the direction of the plane of the arms, the resiliency of the material of which the arms are made, forcing the teeth outwardly at each side to engage the member of the frame and to prevent the withdrawal of the arms. The fastener head, which is secured to the arms, is disposed in a kerf and provided with flanges with cutting edges, which provide means to hold the two members together.

BOOK COVER.—G. H. BECKETT, Belleville, N. J. The invention relates to improvements in removable covers for books, magazines, or the like, and more particularly to means for supporting and securing the book within the cover. The main object is to simplify the construction, so that the cover may be very inexpensively manufactured, but will prove substantial and efficient in use.

BOILER DISINCRUSTING COMPOUND.—R. L. DE GUEVARA, Vera Cruz, Mexico. Among the principal objects here are: To provide a compound which prevents the accumulation of scale or other incrustating coatings in boilers; to provide a compound the neutralizing effect of which is calculable and may be added to the water of the boiler in direct ratio to the water consumption thereof; and to provide a compound, simple and non-destructive.

GRAVE BRACE.—A. H. HAVARD, Urbana, Ill. Mr. Havard's invention relates generally to a device which may be used for preventing the caving in of the earth adjacent an excavation and more particularly it relates to a structure of few parts and simple formation which is particularly adapted to prevent the sides of the grave falling in.

CABINET.—K. MANTEY, Eustis, Fla. In this instance use is made of a casing having removably disposed therein a plurality of drawers provided with revoluble means, for containing embroidery and adapted to be revolved when the drawers are withdrawn from the casing, and the bottoms of the drawers being substantially hinged, to permit of revolving the revoluble means when the drawers are in open position.

PIPE COUPLING.—J. MATTHEWS, Newburyport, Mass. The aim in this case is to provide a coupling, arranged to insure quick and accurate bolting together of the coupling flanges after the latter have been screwed in position on the adjacent threaded ends of the pipes to be coupled, and to prevent the bolts from turning and loosening the flanges.

REDUCTION SYSTEM.—A. J. MORLOCK, New York, N. Y. This improvement refers to reduction systems used for cooking, reducing, and converting garbage, offal, slaughter-house tankage, dead animals and fish, and materials of various kinds, for the double purpose of ridding communities of the various objectionable materials mentioned and of making various products and by-products by working up the same.

DETACHABLE SHOVEL TOOTH POINT.—C. H. MULRONEY and I. B. MANNING, Brown Station, N. Y. In the present patent the invention has reference to an improved design of shovel tooth point to be used on steam shovels and other excavating apparatus. It is so constructed that it can be readily put on the end of a tooth and fixed thereto, and readily detached therefrom so as to be replaced when it is worn out.

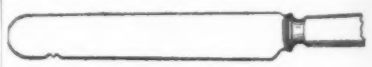
BIRD AND FOWL PERCH.—H. F. SEEBERGER, Jersey City, N. J. This invention pertains to a form of perch or roost, and one object is to provide a form adapted to collect the vermin which infests the fowl, and affords means whereby the perch may be readily cleaned. This is obtained by constructing a perch having recesses inserted from the under side and inclined at an angle to the axis of the perch.

REMOVABLE CALK FOR HORSESHOES.—H. D. WENDT, Hoboken, N. J. The calk-bearing plate engages with the shoe to prevent any lateral movement of the plate, and is clamped over the hoof in such a manner that no portion of the clamping means comes adjacent the rear and tender side of the hoof. The calks proper are removable from the plate, and may be readily replaced when worn or broken.

NECK YOKE CENTER.—M. MARKS, Lemon Cove, Cal. The invention provides an eyelet constructed from pliable sound deadening material; provides an eyelet so made that the anti-rattling material may be readily readjusted or replaced; and provides a loop for the eyelet adjustable to contract or expand to accommodate neck yokes of different diameters.

Hardware and Tools.

KNIFE.—HENRY E. CHANDLER, care of Rogers' Hotel, Minneapolis, Minn. The knife illustrated is for use in cutting steaks, chops, and other meat or food stuffs, raw or cooked, for scaling fish, for separating flesh of poultry from the bones, for separating small joints and ligaments of poultry, etc., and arranged so that the use requires little physical exertion to quickly and properly accomplish the

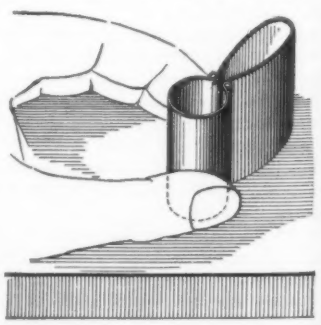


KNIFE.

result desired. Use is made of a tooth integral with the knife blade at the forward end and extending in the plane of the blade, the tooth having its point arranged within the straight cutting edge of the blade, this edge being interrupted for a short distance on both sides of the tooth.

HOSE COUPLING.—H. W. PETERSON, Seattle, Wash. The aim here is to provide a construction in which one of the coupling members will be provided with a packing arranged to be actuated by the pressure of the fluid within the coupled pipes in such manner as to render the pipe joint perfectly tight.

COIN HOLDER.—FREEGIFT VANDERVOORT, Carrizo Springs, Texas. The holder shown in the engraving is adapted to hold a plurality of coins of given size, so as to constitute a package of given value. The aim is to simplify the construction by eliminating end walls, but at the same time effectively retain the coins in position, and to facilitate the



COIN HOLDER.

spreading of the holder at the insertion of the coins. The holder may conveniently be held in the left hand while the coins are inserted with the right, and the spreader may then be pulled out with the right hand, leaving the complete package of coins, which may be picked up without liability of coins slipping out of the lower ends.

FASTENING.—A. H. BOBB, New York, N. Y. The object in this case is to provide a fastening for securing moldings, trims and the like in position without the use of rivets, screws and like fastening devices, the fastening

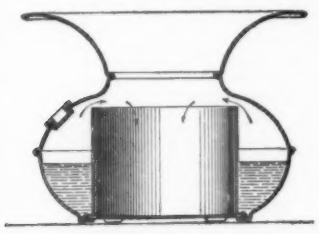
being arranged to allow expansion and contraction of the united parts without danger of becoming detached or loose.

Household Utilities.

KITCHEN SAFE AND DRAWER.—W. W. ATKINSON, Columbia, S. C. An object of this inventor is to provide a safe which may readily be taken apart and collapsed in a small space, for the purpose of storing or shipping the same. Another object is to provide a drawer, the separate parts of which may be readily detached from each other and collapsed in a small space, and also may be readily attached to each other and set up, to form a perfect drawer.

CLOTHES DRIER.—G. R. HOWELL, Southampton, N. Y. This invention relates to clothes driers or racks, for hanging up garments or other articles to dry, or for display, and has reference more particularly to a device of this class, comprising a post, a spindle carried thereby, a head rotatably mounted upon the spindle and seated at the top of the post, and laterally extending arms carried by the head.

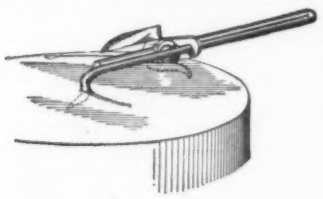
RECEPTACLE.—ALBERT H. HEWES, 716 Clifton Avenue, Newark, N. J. This invention relates to spittoons, water closets, refuse cans, and the like, and its object is to provide a receptacle which is sanitary and which may be conveniently emptied. For the purpose mentioned, use is made of a shell provided with a



RECEPTACLE.

chamber for containing formaldehyde or other disinfectant, and a receiving cup arranged in the shell and having its upper end adjacent to the inner wall of the chamber so that the vapors arising from the disinfecting contents in the chamber pass over the mouth of the cup and thus come in contact with and destroy germs or odors from the cup.

CAN OPENER.—DON P. BAUBLITS, Graham, Mo. The invention pictured herewith relates to openers for cans and other similar kinds of receptacles, and refers more particularly to a device of this class, which has a frame presenting a fulcrum point, a cutter carrier



CAN OPENER.

mounted upon a frame and a rolling cutter mounted upon the carrier and serving to sever the material of the can or other receptacle. The invention also relates to a can opener in which the cutter-carrier is provided with a fixed cutter-blade in addition to the rolling cutter.

Machines and Mechanical Devices.

THREAD GUIDE FOR SPINNING MACHINES.—J. S. FURTARDO, New Bedford, Mass. This invention permits the thread to be readily disposed through the eye of the guide, there being a plurality of slots on the separator finger which are adapted to catch the thread when the traveler breaks, the slots being also adapted to stop the yarn from whipping, to cause the single yarn to break; to cause the double yarn to break; to stop snarls, and also to cause the thread to break if the traveler is too light.

LIQUID WEIGHING MACHINE.—R. W. ENSLEY, Cory, Colo. This improvement provides a machine for filling cartons with heavy or viscous fluid; provides a machine for filling cartons adapted to discontinue the flow of the liquid when the cartons are filled; and provides for discontinuing the flow from the reservoir of material when a prescribed quantity has been delivered therefrom.

MACHINE FOR MANUFACTURING CORRUGATED PAPERS OR CARDBOARDS.—CAMILLE THIEBAUT, Paris, France. This invention has more particularly in view to permit of the mechanical and continuous manufacture of papers or cardboards in which the corrugations are arranged in such a manner as to partly overlap in order to increase the strength of the product and to render its strength substantially equal in every direction of the sheet.

AUTOMATIC ELEVATOR GATE.—J. F. FINAN, Cumberland, Md. An object of the invention is to provide a mechanism comprising a gate which will be lifted by the cage as it approaches the gate, will hold the gate open while at the floor, and which will release the gate as the floor is passed, and wherein the gate at any floor may be passed without opening the same, if desired.

BOX SKID.—L. H. CARLSON, Lorain, Ohio. Mr. Carlson's invention relates to improvements in skids for lowering boxes or packages from a higher to a lower level, as from the level of the sidewalk, street or store to the basement. The main object is to provide a device by means of which the boxes or packages may be lowered readily without danger of breakage.

SAFETY STOP FOR ELEVATORS.—E. KOPPELL, New York, N. Y. This appliance operates clamping jaws or applies the brakes, the same embodying a compound sheave, this compound or set of sheaves and another set being operatively connected to the elevator brakes, and having the safety stop cable looped thereabout, so that in the operation the cable is drawn from the large sheave of the compound sheave and causes the two sets of sheaves to approach each other, the sheaves of the compound preferably having gripping runways so that it is impossible for the cable to slip thereabout.

OYSTER DREDGING AND MANIPULATING MACHINE.—NELS A. LYBECK, Hog Island, R. I. By means of this invention oysters may be elevated from the bed, inspected and transplanted; sorted and transplanted with reference to sorting; the foes of oysters captured and exterminated; the bed cleared, cultivated, and leveled; the load when received in the dredging machine may be automatically distributed; the load delivered from the dredger to conveying vessels; the dredging machine turned upon a self-contained center; an oyster scoop and attached devices constructed to ride upon the bed; and a continuous system is provided for distributing oysters and shells from the initial operation of removal from and to the return to the bed.

FAN.—W. F. PRIMLEY and H. E. BAER, Lincoln, Neb. The invention here is to produce a device adapted for use in barber shops, beauty parlors, etc., which may be held in the hand and manipulated about the face and hair for drying the same, and which may be operated in close proximity to the face or hair without danger of injury to the person operated upon.

AUTOMATIC BIT PITCHER.—J. A. PILCHER, Jackson, Ohio. The milling machine is adapted to hold bits or the like, so as to give them the proper pitch. An object is to provide an inclined work-support, which will be readily and quickly adjusted, and which will feed the work positively at the proper angle to the cutting or milling tool.

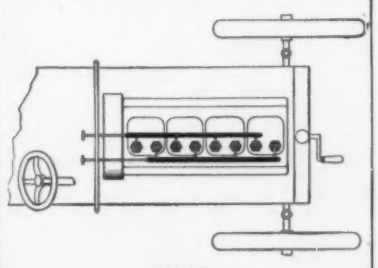
JARRING MACHINE.—C. S. SIMMERS, Cold Spring, N. Y. This jarring machine is adapted to settle, shake down, or even agitate material. An object of the inventor is to provide a device in which the amount or extent of the jar can be varied according to the character of the work which it is desired that the machine shall accomplish.

AEROPLANE.—E. M. YATES, Norman, Okla. Among the principal objects in view are: To provide means whereby the aeroplane is levitated from a stationary position; to provide means for propelling the aeroplane in a horizontal plane; and to provide a structural arrangement to co-act with central ballasting devices whereby the aeroplane is automatically balanced.

VENDING MACHINE.—C. F. CRESS, Frankfort, Ind. An object of this inventor is to provide a device in which the release of the article to be vended is accomplished by means of a coin, through mechanism of few parts, and to provide a device in which there are a plurality of stacks of articles to be vended with means for feeding an article from the bottom of each stack successively, so that the height of the stacks will be approximately the same.

Prime Movers and Their Accessories.

IGNITER.—ELEUTHERE P. DU PONT, Montchanin, Del. Mr. Du Pont's invention is an improvement in igniters, and in the construction pictured in the illustration, each cylinder is provided with two plugs and either set may be made use of by manipulating the two handles at the left, which are connected to the links of an insulating material, the handle portion of the cranks being journaled in the links. Each of the sparking plugs is constructed in accordance with a plug not shown,



IGNITER

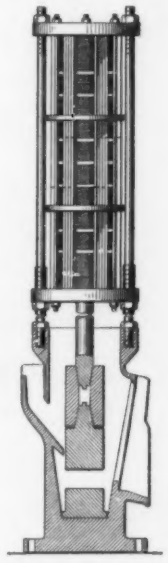
and by closing the valves of the set not in use, such set will be perfectly protected from the products of combustion, and from the intense heat of the combustion chamber.

VALVE GEAR OF INTERNAL COMBUSTION ENGINES.—F. W. LANCHESTER, 53 Hagley Road, Edgbaston, Warwick, England. This invention relates to improvements in valve gear of internal combustion engines, and more particularly to improvements in the actuating gear and method of control of valves of the sliding type especially applicable to engines employing the Otto cycle. The object is the application of a variable cut-off to the intake of the working fluid in an effective manner.

SPREADER BARS FOR TRACTION ENGINE HITCH.—I. J. CHANDONNET, Waubun, Minn. This invention provides means for connecting the hitching cables of grading machines to a traction engine, whereby the machine may be maintained in operative position at the opposite sides of the road while the traction engine travels in the center, and whereby the laterally extended ends of the spreader bars are supported in spaced relation to the surface of the ground.

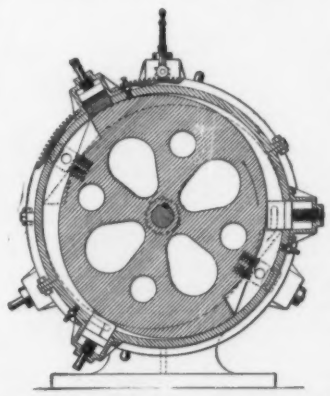
SEPARATOR.—B. W. KINCAID, Wilson, N. C. This invention has reference to improvements in separators and it is especially designed to be used with automobiles and gasolene engines for the purpose of separating the impurities of the liquid fuel from the fuel itself, thereby leaving the latter pure.

ELECTRIC RECIPROCATING ENGINE.—WILLIAM A. STEDMAN, Millers, Nev. The improvement illustrated by the engraving, has among the principal objects in view: To provide means for operating the tamp bars of a stamp mill in fixed serial relation without frictional loss; to provide means whereby individual tamp bars may be independently operated, repaired, or replaced; to provide electric engines for the operation of the tamp bars constructed to facilitate ventilation and heat radiation; and to simplify and economize the construction of stamp mills.



ELECTRIC RECIPROCATING ENGINE

INTERNAL COMBUSTION ROTARY ENGINE.—FRED S. WRIGHT and ARMOND F. WRIGHT, 811 S. Grant Avenue, Tacoma, Wash., In this patent the invention illustrated herewith has reference to internal combustion rotary engines. An object is to provide a rotary engine which is readily reversible. A further object is to provide an engine in which the compression chambers may be made explosion chambers and the explosion chambers may be made compression chambers when the direction of rotation of the engine is reversed.



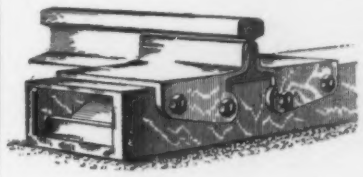
INTERNAL COMBUSTION ROTARY ENGINE.

COOLING CONDENSER FOR GASES.—W. P. NOONAN, Jersey City, and M. J. ROCHE, Weehawken, N. J. This improvement provides a condenser having parallel walls arranged to form a tortuous passage from inlet to outlet; provides a condenser formed from parallel sheets of material arranged to form tortuous passages for gases; provides an air passage there-through to air-cool the inner of said sheets; and provides means for distributing and dissipating gases as the same are admitted to and delivered from the above mentioned tortuous passage.

PUSH ROD FOR DELIVERY VALVES OF INTERNAL COMBUSTION ENGINES.—P. KRÖN, 7 Rue Collange, Levallois-Perret, Seine, France. The invention consists in a push-rod or plunger for operating a delivery valve arranged in such manner as to avoid clearance between the push-rod and the valve. A movable rod serves to operate the valve and is divided in two parts which are maintained constantly applied on the valve rod and the operating valve by means of a suitably arranged spring, the contact between the two parts of the push-rod being effected within a closed chamber and in an oil bath automatically fed between the contact surfaces by displacement of two parts of the push-rod.

Railways and Their Accessories.

METAL TIE.—AUGUSTUS B. CATON and ERNEST A. CARTER, Camden, Texas. The tie shown in the accompanying engraving is an all-metal tie to take the place of the wooden ties now in use and gives the same resilience with increased durability. An object of the inventors is to provide a tie which will be inexpensive to manufacture, and with which it will be difficult for the rails to spread or to be tampered with. A further object is to provide a railroad tie having a connection with the rails, such that the latter have a limited vertical movement resisted by resilient members.



METAL TIE.

Pertaining to Recreation.

PUZZLE GAME BOARD.—H. ENDINGER, New York, N. Y. The object here is to connect certain of the spaces of the continuous course or courses with an inner or central space, by other courses in a way to render possible, yet difficult, the arrangement of the checkers from one prescribed order to another by moving the checkers successively from one space to an adjacent uncovered space, over the connecting course.

VEHICLE.—JAMES M. FOY, Palatka, Fla. This improvement refers to vehicles for use with agricultural implements and other purposes, and has reference more particularly to an automobile vehicle comprising a wheeled frame means for driving certain of the wheels of the frame to propel the vehicle, and means operable independently of the driving wheels, to propel the vehicle.

ELASTIC TIRE.—F. SCHILLER, Prague, Austria-Hungary. This invention relates to elastic tires for road vehicles of all kinds and has for its object to provide an elastic tire of great strength and durability and that may be readily and easily repaired. The wear and tear on this tire as constructed is only slight, and in case of injury only the blocks and hollow bodies injured have to be removed and repaired or replaced by others.

WAGON STAKE.—H. WESLE and H. WESLE, Medford, Wis. This invention relates to wagon stakes, and has reference more particularly to a device comprising a base, means for firmly securing the base to the bolster or to another part of the wagon upon which the stake is to be mounted, a socket, and the stake proper, removably secured in the socket.

Designs.

DESIGN FOR A VASE OR SIMILAR ARTICLE.—C. ZIEGLER, Limoges, France. In this design for a vase or similar article, the front and the back present entirely different designs. The side portion has a shield on one face and is plain on the other. The ornamentations include in not a profuse degree, ribbons, scrolls, and beads. Mr. Ziegler has invented another design for a vase or similar article, wherein the side is provided with two shields instead of one. The ornamentations are similar to the other design.

DESIGN FOR A RAZOR HANDLE.—E. KRUSIUS, West Hoboken, N. J. In this ornamental design for a razor handle, the designer has adopted a very plain treatment, the slightly bowed length of the handle being ornamented only at the ends with four domino shaped bands. The effect is pleasing.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12464) H. H. asks: This question was asked me by one of my men to-day: "How do scientists know and prove that the earth revolves around the sun, and that the sun stands still?" I being the assistant superintendent of this tannery, and more interested in the manufacture of sole leather than astronomy, I was unable to give him a satisfactory answer. I would be very much pleased if you could answer this question in your Notes and Queries. A. It is by no means easy to prove that the earth goes around the sun in a year, instead of the opposite statement that the sun goes around the earth in a year. The appearance of the sky is that the sun moves around the earth, and for many centuries men believed this to be the case. The stars which are now in the east in early evening are seen night by night to be higher above the horizon at the same hour until they pass quite across the sky and disappear from our view for six months. This motion is as well accounted for by supposing that the sun is in motion toward the east as by what is now known to be the true statement that the earth is moving around the sun toward the east. Until the telescope was invented it was generally believed that the earth was the center of the sun's motion, although there were some who held the opposite view. One view or the other must be true. There is no third possibility. There are, however, two phenomena, which could not be detected except by the use of the telescope because of their minuteness, which are conclusive proof that the earth is in motion, and then we know that the sun is the center of the earth's motion. They are the *Aberration of Light* and the *Annual Parallax of the Stars*. Neither of these is easy of explanation, except in scientific terms. By the aberration of light is meant that the stars are not seen in their true places, but are thrown a little in front of their true places by a combination of the motion of their light toward us and the motion of the earth in its orbit around the sun. All stars share this displacement excepting only those in the line of the earth's motion at any time. If we are going directly toward or from a star, it is seen in its true place. But if a star is away on the right or left hand of the earth's line of motion, the star seems to be a little in front of its real position. This is well illustrated by rain falling vertically down while we ride rapidly through the shower. Our motion causes the rain to seem to fall towards us from in front of us. This displacement of the stars is so slight that it can only be made out by the most careful measurements by the telescope. Yet it is very real, and could not take place unless the earth were in motion and the light of the stars also in motion toward us. Since it is the same for all stars, it certainly has its origin in the earth and not in the stars. The annual parallax of the stars is caused by the fact that the earth makes a huge curve in space as it goes around at a distance of 93 millions of miles from the sun. The diameter of the earth's orbit is about 186,000,000 miles. It is to-day a vast and inconceivable distance away from the place in space where it was six months ago. We thus view the stars from points widely separated every six months, and if the stars were not at distances from us vastly greater than this enormous distance, we could see them change their places with reference to each other as the year advances. By minute measurements carried on for many years, certain of the stars have been found to have just the change of place required by such a motion of the earth, and the distances of these stars have been computed upon the basis of such a motion of the earth. In this way the distances of from forty to fifty stars have been determined in the last one hundred years of constant labor on the part of our best astronomers. There is another argument which is of force here, although not relied upon as a proof that the earth revolves around the sun. It is that the sun is so much larger than the earth that it controls the motion of the earth just as it does that of the other planets which we can see revolve around the sun, in the same way as the earth controls the motions of the moon. It is not possible that the sun can revolve around the earth, under a law of attraction such as prevails among the heavenly bodies. The larger always controls the smaller.

(12465) J. N. B. asks: Will you kindly send me the formula used for treating polished brass pipe to secure the dull black finish, similar to that on scientific instruments, such as photometers, etc.? A. As simple a way as any to produce an optical black upon brass is to apply a solution of platinic chloride to the part to be blackened. If the article is small, it may be dipped into the solution. The platinic chloride can be purchased from dealers in chemicals. There are a number of other good methods, some of them cheaper than this, to be found in our "Scientific American Cyclopedia of Formulas," just out of press, which we will send for $5.

(12466) W. L. A. says: Referring to your issue of March 4th, 1911, page 223, allusion is made to a "medium permeable to short waves, but opaque to long ones." And again, "Nor is wool the best insulator." Presumably the article in question was written for the purpose of imparting information to your subscribers, in which case would it not have been as well to have stated the nature of the "medium," and also that of the best "insulator"? The subject may be of much interest to those of your readers who are so situated that they do not have access to well-equipped libraries, and would like to pursue further the matter under discusssion. Will you kindly give the titles of works which contain the details of such "mediums" and "insulators" as those referred to in the article named? A. We are quite willing to supplement the statements of our correspondent in the SCIENTIFIC AMERICAN of March 4th, page 223, concerning the ability of heat waves to penetrate materials. But we would say in the first place that we do not hold ourselves responsible for the statements made in the correspondence column. The facts for which you inquire are to be found in text books of physics under the subject Heat. We may say specifically that glass is rather opaque to long waves, such as those radiated from the ground, but permeable to short ones, such as are sent out by the sun or a hot fire. The glass of a conservatory acts to keep the heat in, but admits the heat of the sun on this principle. So too the best insulator against the long waves is a vacuum. It is on this principle that the "thermos" bottle is constructed. Wool is a better insulator of heat than cotton. Asbestos and magnesia are used for packing to keep heat in, since they are excellent insulators. Indeed, cotton is a very poor material for their use. We wear woolen clothes in cold weather rather than cotton, since it retains the long waves which we generate better than cotton can do. It may be doubted if our correspondent thought he need mention these things.

(12467) R. K. F. asks: To settle an argument will you please publish in your answers to Queries an explanation of the fact that when air is compressed its temperature rises? One party maintains that during compression friction is set up between the molecules of which air is composed. The other maintains that there cannot be any friction, properly speaking, between molecules of a gas, and that the rise in temperature is directly due to the shortening of the free path of the molecules and consequent increase in the number of collisions between them, each collision setting up a wave of heat. A. The heat generated by compressing a gas is due to the greater number of collisions in the gas from forcing the molecules into a smaller space and shortening the mean free path of the molecules. Friction has little heating effect upon a gas.

(12468) T. C. F. asks: In your issue of April 29th, page 431, you give table of star distances, etc., in which appears, "Polaris distance in light years 70 and Vega 35." In Prof. C. A. Young's "Manual of Astronomy," edition of 1904, page 587, Kapteyn's calculations of 1901, he gives Polaris a parallax of 0.074 and distance 44 light years, Vega 21.7. Have there been measurements and calculations in recent years to account for these immense changes in distance? A. The table of the stars in our paper for April 29th, giving the distances of several, about which you inquire, was prepared by Prof. Russell of Princeton University. Prof. Russell is an authority on such matters, and we have no doubt that he used the most reliable data at hand in compiling his list. We should take these results in preference to those of a book published several years ago.

(12469) A. S. D. asks: Natural philosophy teaches that cold contracts and heat expands. Therefore I conclude that matter in its solid state is heavier, bulk for bulk, than matter in its liquid state. Now if this conclusion be true, will you kindly inform me why water ice (solid) will float in water (liquid)? A. It is a general law that anything contracts when it is cooled, and expands when it is heated. You doubtless do not correctly quote your teacher. Cold and heat are not bodies, and cannot contract or expand. Your conclusion is not right that matter is heavier in its solid state than in its liquid state. There are two sorts of bodies. Water expands in freezing, and so ice is lighter than water. Lead on the contrary contracts in becoming solid, and so solid lead sinks in liquid lead. So too do paraffine and beeswax. You can prove this by melting some one of these materials in a dish and dropping a solid piece into the liquid. It will sink in the liquid, showing that it is heavier in the solid form. There are only a few things which expand upon changing from the liquid to the solid form. Water, type metal, and cast iron are the principal ones. You will learn these things by the study of physics, that very interesting and important science.

NEW BOOKS, ETC.

LIFE OF JOHN ERICSSON. By William Conant Church, Editor of the Army and Navy Journal. 8vo.; 357 pp. New York: Charles Scribner's Sons, 1911. Price, $1.50.

The lives of all great engineers are full of interest, and that of John Ericsson, as so ably told in the work before us, is especially so. Apart from his fruitful and distinguished life as an engineer, John Ericsson was a man of unusual personality, and for adequate portraiture, a sympathetic, appreciative biographer was an indispensable necessity. Mr. Church has proved himself in this work to be eminently fitted for the task, and it was the declared wish of John Ericsson that the story of his life should be told by this authority. That he was well furnished for the task is shown by the fact that all of Ericsson's letters and papers were placed at the disposal of Mr. Church by the executors of Ericsson's estate, and that his life-long friend, Mr. John O. Sargent, provided him with numerous letters received during fifty years of intimate intercourse. The work opens with a most readable description of his ancestors and birthplace, and of the local influences amid which Ericsson grew up to manhood. Mr. Church portrays his life in Sweden and the United States and tells, in much detail, the story of Ericsson's well-known work on the screw propeller, the hot-air engine, and gives the best account we have ever read of his development of that precursor of our modern dreadnought, the "Monitor." Too often biographies, even of such interesting characters as Ericsson, are a mere record of facts—reliable, but extremely heavy reading. In the present case all the facts are there, but they are illuminated by a keen observation and a facile pen. The illustrations, which include some admirable portraits of Ericsson at various stages of his life, are numerous and well chosen. We give this work a hearty recommendation.

THE CONSTRUCTION AND WORKING OF INTERNAL COMBUSTION ENGINES. By R. E. Mathot. New York: D. Van Nostrand Company, 1910. 8vo.; 545 pp.; illustrated. Price, $6 net.

The translation from the French is the work of W. A. Tookey. With a view to the requirements of American and British readers, certain descriptions of little-known types have been condensed or omitted altogether, and all the material has been systematically recast and rearranged. The first three chapters convey the author's general knowledge and opinions on the past, present, and future of the internal combustion engine. Chapters IV to XIII bring under review the matters of design and construction. The remaining chapters embody suggestions as to the determination of power and efficiency, and the classification of test results. A device is offered whereby the speed of an engine is controlled by limiting the degree of opening of the inlet valve under the influence of the governor. This admits a variable quantity of mixture, the constituents of which are in constant volumetric ratio. Appendices refer to the bibliography of the subject, and give addresses, classified according to country, of gas engine and gas-producer makers the world over. The work is well printed, and illustrated in the publishers' usual prodigal manner.

TESTING OF ELECTRO-MAGNETIC MACHINERY AND OTHER APPARATUS. By Bernard Victor Swenson, E.E., M.E., and Budd Frankenfield, E.E., assisted by John Myron Bryant, E.E. Vol. II. New York: The Macmillan Company, 1911. 8vo.; 324 pp. Price, $2.60 net.

Six years have been allowed to elapse since the publication of Vol. I, dealing with direct-current electro-magnetic machinery and apparatus. During this time the development of alternating-current theory was so rapid that any published experiments and observations would soon have been out-run and of little practical use. Now, however, it is the belief of the authors that alternating-current development has caught up with direct-current development. The general plan of the first volume has been adhered to, and each experiment is complete in itself. Theory and method are delineated and the necessary data presented; curves are constructed where called for; cautions are given so that accidents and unnecessary repetitions may be avoided; and finally questions that cut to the heart of the subject are asked. In all, one hundred and twenty-seven experiments are given, from the determination of reactance and the measurement of capacities to brake tests and load characteristics.

JAHRBUCH UEBER DIE FORTSCHRITTE AUF ALLEN GEBIETEN DER LUFTSCHIFFAHRT. By Ansbert Vorreiter. Munich: J. F. Lehmann's Verlag, 1911. 507 pp.; 639 illustrations.

Mr. Vorreiter has performed a notable task in publishing this annual volume on the progress made in aerial navigation, both so far as it affects the airship and the flying machine. He divides his book into fourteen sections, with sub-divisions. The first section discusses the airship fleets of all the principal nations of the world; the second, the successful flying machines of the present day; the third, motors for airships and flying machines; the fourth, gliders and kites; the fifth, the free and captive balloon; the sixth, airship fleets and harbors; the seventh, progress in the manufacture of balloon gas; the eighth, weapons for fighting airships; the ninth, flying grounds and fields; the tenth, progress of scientific investigation in the field of airshipping and the technique of flying; the eleventh, the most important German patents on airships; the twelfth, flying as a sport; the thirteenth, aeronautical societies; while the fourteenth is a bibliography.

So rapid is the progress now made in flying machines, that any such work as Mr. Vorreiter has published is bound to be a little out of date by the time it is published. Particularly is this the case in the attempt to bring flying machines up to date. In the section on American flying machines, the reader is informed that the Wright brothers are still building their biplanes according to their original idea without wheeled starting and alighting gear. As a matter of fact, almost every Wright machine now built, both in this country and abroad, makes its preliminary run on wheels and alights on skids. The Wright patent situation, moreover, is not particularly well handled, since the author fails to bring out the fact that the point at issue is whether or not it is necessary to warp the planes and throw over the rudder at the same time, whether or not the vertical rudder and the warping system are operatively connected. Moreover, the decision of the German Patent Office, which is not here recorded, probably because it was made after the book was complete, bears out this viewpoint. Nor is it recorded that there is no obstacle to the making of a flying machine in this country, since the preliminary injunction against the Wrights has been dissolved. Nothing is said of the newer types of machines made by the Wrights, without forward horizontal rudder, or the new type devised by Curtiss, with ailerons. The developments in Europe are recorded with greater accuracy and detail, although here again the advances made are so rapid that it has probably been found impossible to include them all. Thus only one of the new Voisin types is described; the latest of all, which flies with its tail first, not being described or illustrated. The same applies to some new Blériot types. The book is most valuable, perhaps, in its discussion of French and German airships, for here we find a truly admirable account of French and German airships, which shows how very much in advance of America are the foreign powers in encouraging a type of craft which we in America have sadly neglected since we were overwhelmed by the achievements of the flying machine.

DUSTMAN'S BOOK OF PLANS. Chicago: The Charles C. Thompson Company. Price, $2.

Turning the pages of this book, we find plans for one hundred and fifty modern houses, bungalows, and barns. In addition is a great deal of information not generally known outside of the building trades, information which the building public needs. There are instructions as to estimating the labor and material for a building; a convenient and comprehensive specification-form is given; and the suggestions regarding construction to suit varying conditions may be read with profit by intending builders.

MOTION STUDY. A Method for Increasing the Efficiency of the Workman. By Frank B. Gilbreth. New York: D. Van Nostrand Company, 1911. 8vo.; 116 pp.; illustrated. Price, $2 net.

The subject of the workman's efficiency, as increased or limited by the comparative economy of his movements, while not so new a subject as some of the popular magazines would have us suppose, is at the present time being exploited widely. In an introduction to the volume before us, the editor of *Industrial Engineering* cites the case of the city fire department as a popular instance of the development of economy in the accomplishment of "work." Improved methods of harnessing, the horse-releasing device, and the sliding pole by means of which the firemen glide from their quarters above to the ground floor, instead of having to run down stairs, all have so contributed toward cutting down time as to have made it easily possible for the company to be ready to start to a fire before they have received the number of the box. Mr. Gilbreth does not confine his observation to the mere management of work in hand and the use of suitable accessories, but boldly takes into account the anatomy, mental attitude, and experience of the individual workman, even habits and nutrition being considered. After this comes the "variables of the surroundings"—appliances, clothes, heating and lighting, rewards and penalties, fatigue-eliminating devices, and the weight of units to be moved. Then the motion itself is analyzed and studied, under the heads of acceleration, automaticity, combination with other motions, effectiveness, play for position, and speed. The author does not confine himself to theory, but in text and illustration he gives practical examples of results achieved in ordinary occupations such as the lading of wagons, the wheeling of trucks, and the laying of bricks.

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Waterspouts

(Continued from page 564.)

tornado is applied specifically to the particularly violent landspouts that are common in certain parts of the United States.

We have seen that dust whirls occur only when the surface of the ground is excessively heated, and during their brief existence they are fed by the inflow of the lower air. The sharp contrasts of temperature that produce them are characteristic of a land surface as compared with a water surface; yet it is over the latter that spouts are most frequent. Here, then, is one point of difference between the dust whirl and the spout. Another is the fact that no surface inflow of the air is observed about a spout, except immediately within it. A waterspout may pass within a few hundred feet of a vessel when the latter is absolutely becalmed. Both of these circumstances prove the inaccuracy of the common statement that spouts are due to an unstable condition of overheated air at the earth's surface.

Both theory and observation indicate that the vortex of a spout originates at a considerable altitude above the earth—viz., at the level of the middle or lower clouds—and is thence propagated downward. The explanation of its origin must be sought in the contrasts of temperature occurring, at high levels, on the margin of a large cyclone; the zone in which spouts originate being identical with that in which squalls (vortices with horizontal axes) are also most common. Frequently it fails to reach the earth's surface. Incomplete waterspouts are often observed dangling from the clouds, with no agitation of the water beneath such as would indicate that the vortex extended to the lowest stratum of the air.

Waterspouts are common within the tropics, especially in the equatorial region of calms and baffling winds known as the "doldrums." The East Indies, the Guinea coast, the Red Sea and the Mediterranean are some of their favorite haunts.

It is hardly necessary to state that a waterspout does not consist of *water*, in the ordinary sense of the term. A vortex in the air, formed as described above, is gradually pushed downward. If it reaches the surface of the ocean the latter will be violently disturbed; the water will be dashed upward in the form of waves and spray to a height of many feet, forming the characteristic broad base of the spout. Extending above this to the level of the clouds the centrifugal action of the vortex causes, within its core, a rarefaction of the air—a region of diminished pressure—in which water vapor, previously gaseous and invisible, is condensed, by the cooling due to expansion, into a column of mist. This column is often a mere watery film, so that vessels, mountains and the like, lying beyond the spout, can be distinctly seen through it.

Although the vortex, and the resulting visible column of mist, grows downward, the air in the spout moves chiefly upward, in spiral paths, often with force enough to carry heavy objects aloft, as is commonly seen in the tornado.

When a waterspout suddenly breaks, owing to a cessation of its vortical motion, its moisture may be discharged downward in the form of a torrential rain. This has sometimes happened over a ship, and the water was observed to be fresh, not salt, proving that no considerable part of it was drawn directly from the ocean.

The forms of waterspouts are various. Sometimes they are seen singly, sometimes in groups. As many as twenty have been observed at one time. Their height, in extreme cases, may reach nearly a mile.

Some of the most interesting descriptions and pictures of waterspouts are to be found in a memoir published in 1898 by the late H. C. Russell, Government Astronomer at New South Wales. In one case cited by this author fourteen complete spouts, and six others more or less incomplete, were seen within the space of five hours. Russell also records a case in which the shaft of a waterspout formed a complete loop; a phenomenon that has occasionally been mentioned by other writers. The description follows:

"August 18th, 1894. Mr. Richard Taplin, master of the steamship "Burrawong," writes: 'When fifteen miles

south of Seal Rocks and going south we saw before us a waterspout in the midst of a black and heavy looking rain cloud; it looked like a bright funnel and the tube descended to the sea, which it lashed into a fierce whirlpool.

The spout was traveling to the northwest, and passed us three-quarters of a mile to westward. I estimated the speed it was traveling forward at about twelve to fifteen miles per hour. The second one was not so large, but otherwise very similar, and it passed away in the same direction. The third and last one was very beautiful; it formed under the southeastern extremity of the very dark rain cloud, and it traveled in the same direction as the other two. Its funnel-like shape was like the first one, but it was much longer and closer to the ship, so that we could see it very well. As it came bowling along at the rate of twenty miles per hour, we could see the water spouting up in a continuous and uniform stream right up to the cloud.

When the waterspout was about two miles to the northwest of our ship it suddenly presented a very curious and fantastic shape; it became very long, swaying and coiling about like a serpent. All at once it made a complete coil (see illustration), then burst, great quantities of water poured out of the lower part of the coil, and in a few seconds one of the most beautiful sights I have ever witnessed during my seafaring career vanished as completely as if it had never been in existence.'"

If mariners were once a prey to a superstitious dread of waterspouts, on the other hand the sailor of to-day is perhaps inclined to go to the other extreme. Sea captains have been quoted as saying that they would not be afraid to run their vessels into any waterspouts they had ever seen. There are, however, several cases on record in which vessels have come off much the worse for involuntary encounters with waterspouts. In 1895 the German bark "Ceylon," Capt. Niemann, bound from Antwerp to Philadelphia, met a waterspout in about 31 deg. north lat. and 71 deg. west long.

Most of her canvas was furled at the time, as she had recently encountered a thunder squall, and hence it was not possible to sail out of the way of the spout, when it was seen rapidly approaching. The spout struck the vessel on the port side, and heeled her over until the starboard yardarms nearly touched the water. At the same time she was swung around from north-northwest to south-southeast, and then thrown over to port, on her beam ends, with such violence that her mainmast and mizzenmast went by the board.

On the coast of Guinea, in 1674, a sixteen-gun man-of-war of 300 tons was similarly mishandled by a waterspout, losing her foremast and bowsprit in the encounter.

The Paris-Rome-Turin Aeroplane Race

(Continued from page 565.)

that he abandoned the race at this point. Bathiat reached Lyons the evening of June 1st, after having had another breakdown. Lieut. Lucca, while flying from Avignon to Nice on June 1st, was forced to alight at Heyeres, near Marseilles, owing to a thick fog. The next morning he made a fine start and flew over the city, but returned shortly after in order to adjust his motor. Just as he was about to alight, his Henry Farman biplane upset. When the aviator and his passenger were removed from the wreckage, it was found that each man had a broken leg.

The race to Rome was notable from the fact that two aviators, at least, made the trip in record time, although they suffered various mishaps and motor breakdowns. The endurance of these men, as well as of their machines, must have been very great in order to stand so many hours of flight in all kinds of weather, interspersed with heavy landings in dangerous places. M. Garros was apparently in very poor physical condition on his arrival at Rome, but after a few days' rest he will undoubtedly be recuperated sufficiently to give Lieut. Conneau an excellent race for the 391 miles remaining.

Electricity

Effort to Restore Life by Electricity.—A workman employed by the General Electric Company at West Lynn, Mass., was killed recently by a discharge of current under pressure of 3,500 volts. Every effort was made to resuscitate the man, but after physicians had found it impossible to restore him to life, Prof. Elihu Thomson, who happened to be present, with the assistance of Dr. George E. Woodville, endeavored to stimulate heart action by subjecting the man to a current under 50,000 volts pressure. The experiment was eventually given up after a number of charges failed to produce any signs of life.

Electricity and the Growth of Children.—At the suggestion of Prof. Svante Arrhenius, an experiment is being tried in Stockholm upon fifty school children. The children are divided into two groups identical in point of health, height, weight, etc., and are placed in two class rooms of the same dimensions, and similarly situated as regards exposure to light. In each class room, exactly the same teaching is given, but one of the class rooms is subjected to electricity, while the other is not. As yet the experiment has not been drawn to a close, but it is reported that the "electrified children" have shown a greater mental and physical development than those in the other class room.

Test of Electric Automobiles.—On June 6th a very interesting contest of electric automobiles will be conducted by the Electrical Automobile Dealers' Association. The object of the contest is to demonstrate the value of the electrical automobile for visits to suburban towns and for shopping trips. The entrants will start from Columbus Circle, New York, and make a trip on Long Island of from 60 to 70 miles on a single charge. An average speed of about 12 miles per hour will be maintained, with stops occasionally as if for shopping purposes. The exact schedule time allowed will be kept secret, and when the contest is over, those whose time happens to be nearest to that of the schedule will receive prizes.

Electrical Lock Gate Machines for Panama.—Plans for electric machinery to operate the locks of the Panama Canal have just been made public. Each leaf of the lock gates will be operated by a separate motor, and in addition there will be a miter-forcing machine operated by a separate motor, to lock the leaves together. Each leaf will be connected by a connecting rod to a "bull wheel," or crank wheel, which may be moved through an arc of 197 degrees by a train of gearing driven by the motor. The "bull wheel" will be 19 feet 2 inches in diameter, and will be mounted horizontally on the lock wall, being supported at the rim upon rollers. The connecting rod will be provided with a shock absorber to withstand wave action and the like. The operation of swinging a leaf open or closed will take but two minutes. After the leaves are closed they will be locked by means of a pair of jaws on one leaf and a pin on the other, which will be seized by the jaws under action of the miter-forcing machine.

Destroying a Wooden Bridge by Electricity.—An interesting use of electricity was recently demonstrated in England, where a wooden bridge was cut down by means of electrically heated wires. The bridge had been condemned, and was to be replaced by a steel structure supported on the old masonry piers and abutments. Three weeks was allowed in which to dismantle the woodwork, but it proved impossible to accomplish the work in so short a time without the use of dynamite or fire, which undoubtedly would have injured the masonry. Finally an electrician proposed to destroy the bridge by the use of electricity. Each span of the bridge contained twenty-seven planks, and it was proposed to cut them so that they would drop into the water simultaneously, clear of the piers. The structure was wired and sufficient current was employed to bring the wires to a cherry red. An hour and forty minutes after the current was applied, the first span was cut and fell into the water. The operation was begun at 5 o'clock in the morning, and at 2 o'clock at night the structure had been demolished without injuring the masonry.

Science

Identifying Bullets.—In an address to the Paris Academy of Sciences, Prof. Balthazard contends that when a leaden bullet traverses cloth, characteristic marks are left upon it, which are not obliterated by the subsequent passage of the bullet through flesh, provided that it does not strike a bone. It is even possible, he claims, to identify the nature of the garment through which the bullet has passed by a careful examination of the marks on the lead.

Tenth of a Second.—It is not common to find a person who can correctly estimate the lapse of a single second. But, in these days of speeding automobiles, the exact time when each of two colliding vehicles must have occupied particular spots may be a matter of great importance. In a recent experiment a car took nearly two seconds to stop after brakes were applied, and in that time it moved nineteen feet. So even fractions of a second are important. One can train himself to estimate even tenths of a second. Try it with a watch, and it will be found that it is just possible to count 10 in the lapse of a single second. But one must count very fast to do it.

Cotton in France.—It is desired to promote cotton raising in the French colonies so that France will not be obliged to import its supply. At present it imports 250,000 tons valued at over $60,000,000. Two-thirds of the supply comes from the United States, and it is evident that there are many reasons why the supply might be cut off at any time in the future, either on account of a crisis or from the fact that all the cotton would be used in America, hence the need for taking some measures in order to prevent this. M. Audiffred and others recommend that the State encourage cotton raising in the French colonies by allowing subsidies for this purpose.

Largest of Flowers.—The largest of all the flowers of the world is said to be the Raffesia, a native of Sumatra, so called after Sir Stamford Raffles. This immense plant is composed of five round petals of a brickish color, each measuring a foot across. These are covered with numerous irregular yellowish white swellings. The petals surround a cup nearly a foot wide, the margin of which bears the stamens. The cup of the Raffesia is filled with a fleshy disk, the upper surface of which is covered with projections like miniature cows' horns. The cup, when free from its contents, will hold about twelve pints. The flower weighs about fifteen pounds, and is very thick, the petals being three-quarters of an inch.

Protection from X-Rays.—In order to protect operators against the harmful effects of X-rays, Dr. Aubourg, of Paris, covers the head and also the rest of the body. On the head is a rubber protector somewhat resembling an ancient armor helmet. A pair of glasses covers the eyes, and the glass used here is a kind of lead glass which is found best to act as a screen. The operator wears a blouse or apron which is lined with thin sheet lead together with rubber and bismuth. On the hands are worn thick gloves having a like protecting covering. Such armor is not always needed, but can be used by doctors who are much affected by the rays or who are already injured by them.

Cold Storage in Europe.—Many of the European cities are following the example of America as regards cold storage plants. Paris is one of the centers where such questions are now being promoted, and the Refrigeration Society is endeavoring to bring such question before engineers and manufacturers. Not long since there has been built a large cold storage plant in the suburbs of Paris and lying on the North railroad. It is designed to store home products which are to be exported, as well as foreign products brought in by rail to be consumed in the city. There are now eleven cold storage chambers in operation. A convenient system in the use of an automobile wagon with freezing compartments which plies between the city and the storage house. It carries the products to the sellers in town, and also takes back the unsold products for storage.

RAILROADS OF A CONTINENT

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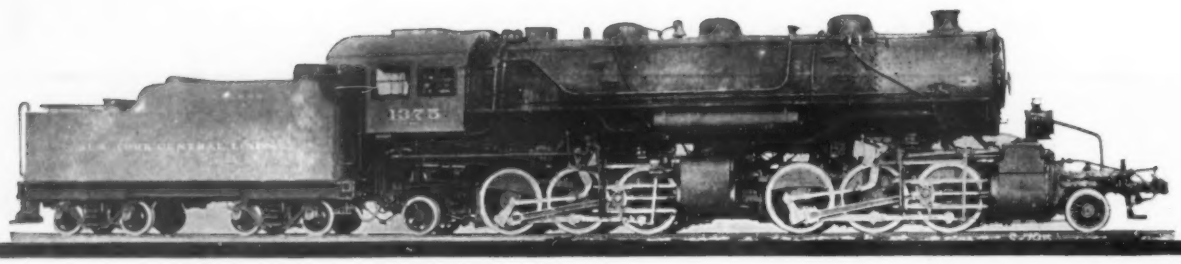

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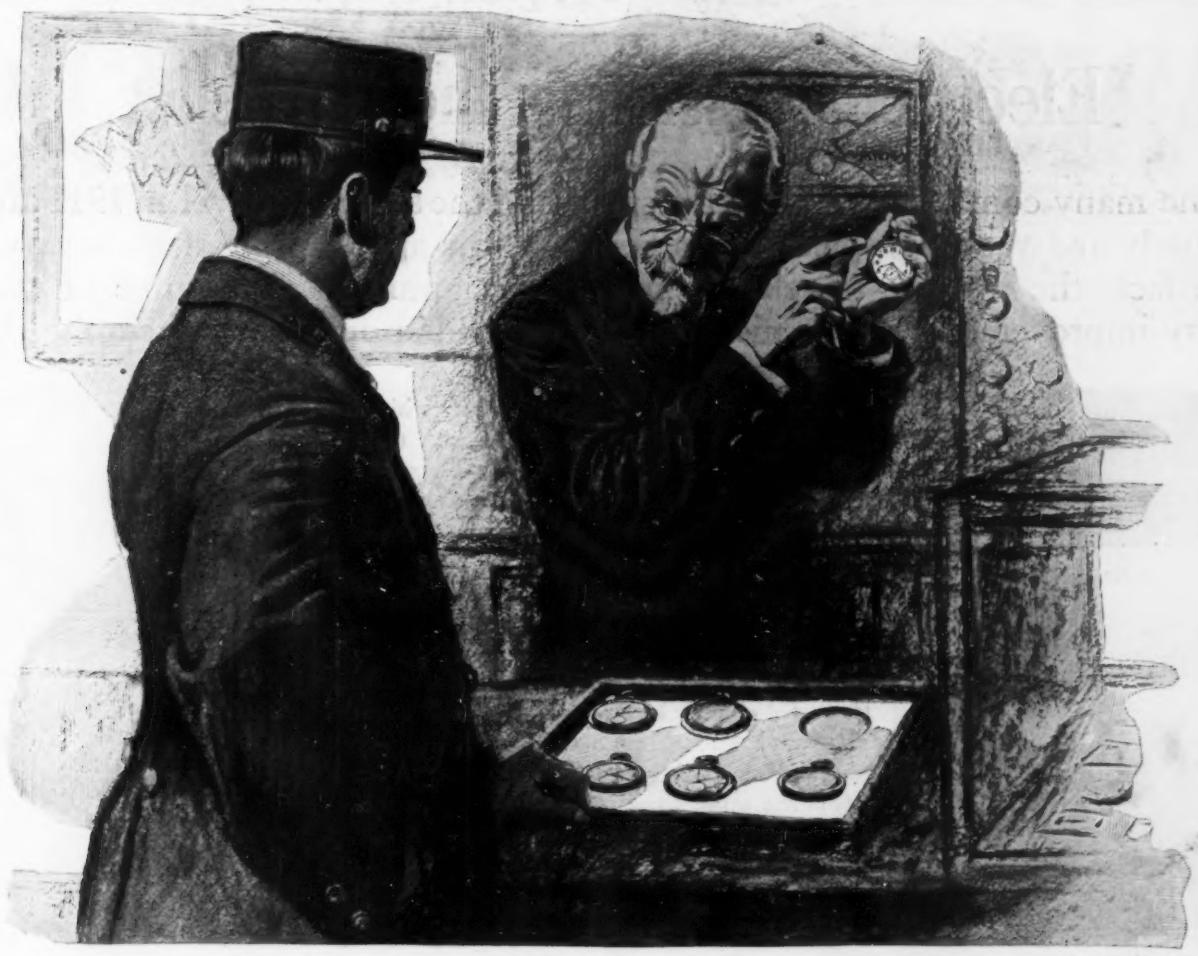

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